Harvard University

THE

LAWRENCE SCIENTIFIC SCHOOL

OCTOBER

1900

THE

LAWRENCE SCIENTIFIC SCHOOL

OF

HARVARD UNIVERSITY

CATALOGUE OF OFFICERS AND STUDENTS
ANNOUNCEMENTS

CAMBRIDGE
Published by the University
1900

1900.

JULY.

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SCIENTIFIC SCHOOL CALENDAR.

1900.

Sept. 17–22, Monday to Saturday. Examinations for admission to Harvard College and the Lawrence Scientific School.

Sept. 26, Wednesday. Annual Meeting of the Board of Overseers. Registration of students.

Sept. 27, Thursday. **Academic Year** begins. Registration of students continued.

Oct. 31, Wednesday. Last day for receiving applications of candidates for Final Honors (except in Geology) in 1901.

Nov. 1, Thursday. Last day for receiving essays for the William H. Thorndike Prize.

Nov. 29, Thursday. Thanksgiving Day; a holiday.

Recess from December 23, 1900, to January 2, 1901, inclusive.

1901.

Feb. 11, Monday. **Second half-year** begins.

Feb. 22, Friday. Washington's Birthday; a holiday.

March 1, Friday. Last day for receiving applications of candidates for Final Honors in Geology in 1902.

March 30, Saturday. Last day for re-engaging College Rooms for 1901–02.

Apr. 1, Monday. Last day for receiving essays for the Bowdoin Prizes.

Recess from April 14 to April 20, inclusive.

May 1, Wednesday. Last day for receiving theses of candidates for the degree of S.D.

May 1, Wednesday. Last day for receiving dissertations for the Dante, Toppan, and Sumner Prizes.

May 1, Wednesday. Notice of intention to compete for the Sales Prize must be given on or before this date.

May 2, Thursday. Last day for receiving applications for College Rooms for 1901–02.

May 4, Saturday. Assignment of College Rooms for 1901–02.

May 30, Thursday. Memorial Day; a holiday.

June 1, Saturday. Last day for receiving applications for Scholarships for 1901–02.

June 21, Friday. Seniors' Class Day.

June 24–29, Monday to Saturday. Examinations for admission.

June 26, Wednesday. **Commencement.**

Summer Vacation of Thirteen Weeks, from Commencement Day to September 26, inclusive.

DEPARTMENTS OF HARVARD UNIVERSITY.

The University comprehends the following departments: —

Harvard College,
The Lawrence Scientific School,
The Graduate School,
The Divinity School,
The Law School,
The Medical School,
The Dental School,
The School of Veterinary Medicine,
The Bussey Institution (a School of Agriculture),
The Arnold Arboretum,
The University Library,
The Museum of Comparative Zoölogy,
The Peabody Museum of American Archaeology and Ethnology.
The University Museum,
The Botanic Garden,
The Gray Herbarium,
The Astronomical Observatory.

☞ Students in regular standing in any one department of the University are admitted free to the instruction and the examinations given in any other department, with the exception of exercises carried on in the special laboratories. (This rule does not apply to Special nor to Graduate Students unless they pay the full fee of $150 a year.)

ADMINISTRATIVE OFFICERS.

President of the University: Charles William Eliot, ll.d.
Office, 5 University Hall, Cambridge.

Treasurer: Charles Francis Adams, 2d, a.b., ll.b.
Office, 50 State St., Boston.

Dean of the Faculty of Arts and Sciences: Clement Lawrence Smith, a.m., ll.d.
Office, 5 University Hall.

Dean of the Lawrence Scientific School and Chairman of the Committee on the Summer School: Nathaniel Southgate Shaler, s.d.
Office, 16 University Hall. Office hours, daily, 9 a.m., except Saturday.

Secretary of the Lawrence Scientific School and Clerk of the Summer School: James Lee Love, a.m.
Office, 16 University Hall. Office hours, daily, 9 a.m., also, except Saturday, 2 p.m.

Recorder of the Faculty of Arts and Sciences: George Washington Cram, a.b.
Office, 4 University Hall. Office hours, 9 a.m. to 1 p.m.; Saturday, 9 a.m. to 12 m.

Bursar of the University: Charles Frank Mason, a.b.
Office, Dane Hall, Cambridge. Office hours, 9 a.m. to 1 p.m.

Librarian: William Coolidge Lane, a.b.
Office, Gore Hall, Cambridge.

Director of the Hemenway Gymnasium: Dudley Allen Sargent, m.d., s.d.
Office, Hemenway Gymnasium.

Regent: George Alonzo Bartlett, a.m.
Office, 5 University Hall.

Corresponding Secretary of the University: Richard Cobb, a.b.
Office, 5 University Hall, Cambridge. Office hours, daily, 9 a.m. to 10 a.m.

Publication Agent of the University: John Bertram Williams, a.b.
Office, 2 University Hall, Cambridge. Office hours, 9 a.m. to 5 p.m.; Saturday, 9 a.m. to 12.30 p.m.

THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE.

This Board is commonly known as the CORPORATION.

PRESIDENT.

CHARLES WILLIAM ELIOT, LL.D.,
17 Quincy St., Cambridge.

FELLOWS.

HENRY PICKERING WALCOTT, A.B., M.D.,
11 Waterhouse St., Cambridge.

HENRY LEE HIGGINSON, A.M., 44 State St., Boston.

SAMUEL HOAR, A.B., Concord.

FRANCIS CABOT LOWELL, A.B.,
709 Exchange Building, Boston.

ARTHUR TRACY CABOT, A.M., M.D.,
3 Marlborough St., Boston.

TREASURER.

CHARLES FRANCIS ADAMS, 2d, A.B., LL.B.,
50 State St., Boston.

THE BOARD OF OVERSEERS.

The PRESIDENT and TREASURER of the University, *ex officio*, and the following persons by election: —

1901.*

THEODORE ROOSEVELT, A.B., LL.D., Executive Mansion, Albany, N. Y.

CHARLES FRANCIS ADAMS, A.B., LL.D., 23 Court St., Boston.

EDMUND WETMORE, A.B., LL.B., 34 Pine St., New York, N. Y.

ROBERT BACON, A.B., 23 Wall St., New York, N. Y.

ROBERT GRANT, PH.D., LL.B., 205 Bay State Road, Boston.

1902.

SOLOMON LINCOLN, A.M., LL.B., *President*, 191 Commonwealth Ave., Boston.

DAVID WILLIAMS CHEEVER, M.D., LL.D., 557 Boylston St., Boston.

GEORGE BRUNE SHATTUCK, A.M., M.D., 183 Beacon St., Boston.

FRANCIS RAWLE, A.M., LL.B., 328 Chestnut St., Philadelphia, Pa.

EDWIN PLINY SEAVER, A.M., LL.B., Waban.

1903.

CHARLES JOSEPH BONAPARTE, A.B., LL.B., 216 St. Paul St., Baltimore, Md.

CHARLES FOLLEN FOLSOM, A.M., M.D., 15 Marlborough St., Boston.

JAMES JACKSON STORROW, A.B., LL.B., 40 Water St., Boston.

FRANCIS LEE HIGGINSON, A.B., 50 State St., Boston.

GEORGE ANGIER GORDON, A.B., D.D., 645 Boylston St., Boston.

* The term expires, in each case, on Commencement Day of the year indicated.

1904.

MOORFIELD STOREY, A.M., 735 Exchange Building, Boston.

JOHN NOBLE, A.B., LL.B., Court House, Pemberton Sq., Boston.

WINSLOW WARREN, A.B., LL.B., 39 Court St., Boston.

HENRY SHIPPEN HUIDEKOPER, A.M., P. O. Box 533, Philadelphia, Pa.

GEORGE EVERETT ADAMS, A.M., LL.B., 530 Belden Ave., Chicago, Ill.

1905.

WILLIAM AMOS BANCROFT, A.B., 12 Ware St., Cambridge.

CHARLES ELIOT NORTON, Litt.D., LL.D., Shady Hill, off Irving St., Cambridge.

JOHN FISKE, Litt.D., LL.D., 22 Berkeley St., Cambridge.

WILLIAM EVERETT, L.H.D., LL.D., Quincy.

STEPHEN MINOT WELD, A.M., 89 State St., Boston.

1906.

SAMUEL HILL, A.B., Minneapolis, Minn.

GEORGE FRISBIE HOAR, LL.B., LL.D., Worcester.

WILLIAM LAWRENCE, A.B., D.D., 101 Brattle St., Cambridge.

EDWARD WILLIAM HOOPER, LL.B., LL.D., 49 Beacon St., Boston.

SECRETARY OF THE BOARD OF OVERSEERS.

ALEXANDER McKENZIE, A.M., D.D., 12 Garden St., Cambridge.

THE FACULTY OF ARTS AND SCIENCES.

FACULTY OF ARTS AND SCIENCES.

Charles William Eliot, LL.D., President.

Clement Lawrence Smith, A.M., LL.D., Dean, and *Professor of Latin.*

William Watson Goodwin, Ph.D., LL.D., D.C.L., *Professor of Greek Literature.*

Ferdinand Bôcher, A.M., *Professor of Modern Languages.*

James Bradley Thayer, LL.B., LL.D., *Professor of Law.*

Adams Sherman Hill, A.B., LL.B., *Professor of Rhetoric and Oratory.*

James Mills Peirce, A.M., *Professor of Astronomy and Mathematics.*

Asaph Hall, Ph.D., LL.D., *Lecturer on Celestial Mechanics.*

James Bradstreet Greenough, A.B., *Professor of Latin.*

Crawford Howell Toy, A.M., LL.D., *Professor of Hebrew.*

John Knowles Paine, A.M., Mus.D., *Professor of Music.*

George Lincoln Goodale, M.D., LL.D., *Professor of Natural History*, and *Director of the Botanic Garden.*

Charles Herbert Moore, A.M., *Professor of Art*, and *Director of the Fogg Art Museum.*

Frederic Ward Putnam, A.M., S.D., *Professor of American Archaeology and Ethnology*, and *Curator of the Peabody Museum.*

Nathaniel Southgate Shaler, S.D., *Professor of Geology*, and *Dean of the Lawrence Scientific School.*

George Herbert Palmer, A.M., Litt.D., LL.D., *Professor of Philosophy.*

John Trowbridge, S.D., *Professor of Physics*, and *Director of the Jefferson Physical Laboratory.*

George Alonzo Bartlett, A.M., *Associate Professor of German*, and *Regent.*

William Gilson Farlow, M.D., LL.D., *Professor of Cryptogamic Botany.*

William James, M.D., Ph. et Litt.D., LL.D., *Professor of Philosophy.*

Charles Loring Jackson, A.M., *Professor of Chemistry.*

Frédéric César de Sumichrast, *Associate Professor of French.*

John Williams White, Ph.D., LL.D., Litt.D., *Professor of Greek.*

William Morris Davis, M.E., *Professor of Geology.*

Henry Barker Hill, A.M., *Professor of Chemistry*, and *Director of the Chemical Laboratory.*

Francis Greenwood Peabody, A.M., D.D., *Professor of Christian Morals.*

John Joseph Hayes, *Instructor in Elocution.*

Minton Warren, Ph.D., LL.D., *Professor of Latin.*

William Elwood Byerly, Ph.D., *Professor of Mathematics.*

Ephraim Emerton, Ph.D., *Professor of Ecclesiastical History.*

Charles Rockwell Lanman, Ph.D., *Professor of Sanskrit.*

Edward Laurens Mark, Ph.D., LL.D., *Professor of Anatomy.*

Edward Stevens Sheldon, A.B., *Professor of Romance Philology.*

Silas Marcus Macvane, Ph.D., *Professor of History.*

Robert Wheeler Willson, Ph.D., *Assistant Professor of Astronomy.*

John Henry Wright, A.M., *Professor of Greek*, and *Dean of the Graduate School.*

Le Baron Russell Briggs, A.M., LL.D., *Professor of English*, and *Dean of Harvard College.*

Kuno Francke, Ph.D., *Professor of German Literature.*

Edwin Herbert Hall, Ph.D., *Professor of Physics.*

David Gordon Lyon, Ph.D., *Professor of Divinity*, and *Curator of the Semitic Museum.*

Josiah Royce, Ph.D., LL.D., *Professor of the History of Philosophy.*

Philippe Belknap Marcou, Ph.D., *Assistant Professor of Romance Languages.*

Charles Pomeroy Parker, A.B., *Assistant Professor of Greek and Latin.*

Benjamin Osgood Peirce, Ph.D., *Professor of Mathematics and Natural Philosophy.*

Eugene Wambaugh, LL.B., LL.D., *Professor of Law.*

Hans Carl Günther von Jagemann, Ph.D., *Professor of Germanic Philology.*

Abbott Lawrence Lowell, A.B., LL.B., *Professor of the Science of Government.*

Edward Henry Strobel, A.B., LL.B., *Professor of International Law.*

Barrett Wendell, A.B., *Professor of English.*

Edward Channing, Ph.D., *Professor of History.*

Charles Gross, Ph.D., *Assistant Professor of History.*

Paul Henry Hanus, S.B., *Assistant Professor of the History and Art of Teaching.*

Ira Nelson Hollis, A.M., L.H.D., *Professor of Engineering.*

Hugo Karl Schilling, Ph.D., *Assistant Professor of German.*

Frank William Taussig, Ph.D., LL.B., *Professor of Political Economy.*

John Eliot Wolff, Ph.D., *Professor of Petrography and Mineralogy*, and *Curator of the Mineralogical Museum.*

Albert Bushnell Hart, Ph.D., *Professor of History.*

Alfred Bull Nichols, A.B., S.T.B., *Instructor in German.*

Herbert Langford Warren, *Professor of Architecture.*

William James Ashley, A.M., *Professor of Economic History.*

Morris Hicky Morgan, Ph.D., LL.D., *Professor of Classical Philology.*

Charles Robert Sanger, Ph.D., *Assistant Professor of Chemistry.*

Joseph Henry Beale, Jr., A.M., LL.B., *Professor of Law.*

Charles Townsend Copeland, A.B., *Instructor in English*, and *Lecturer on English Literature.*

Albert Andrew Howard, Ph.D., *Assistant Professor of Latin.*

George Lyman Kittredge, A.B., *Professor of English.*

Roland Thaxter, Ph.D., *Assistant Professor of Cryptogamic Botany.*

Charles Hall Grandgent, A.B., *Professor of Romance Languages.*

Hugo Münsterberg, Ph.D., M.D., *Professor of Psychology.*

Henry Lloyd Smyth, A.B., C.E., *Professor of Mining and Metallurgy.*

Heinrich Conrad Bierwirth, Ph.D., *Instructor in German.*

Lewis Edwards Gates, A.B., *Assistant Professor of English.*

Robert Tracy Jackson, S.D., *Assistant Professor of Palaeontology.*

James Lee Love, A.M., *Instructor in Mathematics*, and *Secretary of the Lawrence Scientific School.*

Joseph Torrey, Jr., Ph.D., *Instructor in Chemistry.*

John Hays Gardiner, A.B., *Assistant Professor of English.*

John Winthrop Platner, A.B., *Assistant Professor of Ecclesiastical History.*

William Fogg Osgood, Ph.D., *Assistant Professor of Mathematics.*

Theodore William Richards, Ph.D., *Assistant Professor of Chemistry.*

Wallace Clement Sabine, A.M., *Assistant Professor of Physics.*

George Santayana, Ph.D., *Assistant Professor of Philosophy.*

George Pierce Baker, A.B., *Assistant Professor of English.*

Archibald Cary Coolidge, Ph.D., *Assistant Professor of History.*

Jefferson Butler Fletcher, A.M., *Instructor in English.*

Byron Satterlee Hurlbut, A.M., *Instructor in English*, and *Recording Secretary.*

Lewis Jerome Johnson, A.B., C.E., *Assistant Professor of Civil Engineering.*

George Howard Parker, S.D., *Assistant Professor of Zoölogy.*

Walter Raymond Spalding, A.M., *Instructor in Music.*

Maxime Bôcher, Ph.D., *Assistant Professor of Mathematics.*

Walter Safford Burke, *Assistant Professor of Mechanical Engineering.*

Irving Babbitt, A.M., *Instructor in French.*

Clifford Herschel Moore, Ph.D., *Assistant Professor of Greek and Latin.*

James Hardy Ropes, A.B., S.T.B., *Assistant Professor of New Testament Criticism and Interpretation.*

William Henry Schofield, Ph.D., *Instructor in English.*

Robert DeCourcy Ward, A.M., *Assistant Professor of Climatology.*

Charles Burton Gulick, Ph.D., *Assistant Professor of Greek.*

Comfort Avery Adams, Jr., S.B., *Assistant Professor of Electrical Engineering.*

Thomas Nixon Carver, Ph.D., *Assistant Professor of Political Economy.*

William Guild Howard, A.M., *Instructor in German.*

Fred Norris Robinson, Ph.D., *Instructor in English.*

Daniel Lawrence Turner, C.E., *Instructor in Surveying and Hydraulics.*

Jay Backus Woodworth, S.B., *Instructor in Geology.*

Charles Henry Conrad Wright, A.M., *Instructor in French.*

Charles Leonard Bouton, Ph.D., *Instructor in Mathematics.*

Richard Cobb, A.B., *Instructor in English*, and *Corresponding Secretary.*

Lionel Simeon Marks, S.B., M.M.E., *Assistant Professor of Mechanical Engineering.*

Charles Palache, Ph.D., *Instructor in Mineralogy.*

William Ernest Castle, Ph.D., *Instructor in Zoölogy.*

Thomas Augustus Jaggar, Jr., Ph.D., *Instructor in Geology.*

Jeremiah Denis Matthias Ford, Ph.D., *Instructor in French.*

George Frederic Newton, *Instructor in Designing and Drawing.*

Jens Iverson Westengard, LL.B., *Assistant Professor of Law.*

Frank Russell, S.M., Ph.D., *Instructor in Anthropology.*

APPOINTED FOR THE YEAR 1900–01.

PREACHERS TO THE UNIVERSITY.*

Lyman Abbott, D.D., LL.D.,	New York, N. Y.
George Foot Moore, D.D.,	Andover.
Endicott Peabody, LL.M., S.T.B.,	Groton.
Paul Revere Frothingham, A.M., S.T.B.,	New Bedford.
Robert MacDonald, A.M., S.T.B.,	Brooklyn, N. Y.

MEDICAL VISITOR.

Marshall Henry Bailey, M.D.,	47 Brattle St.

LECTURERS AND INSTRUCTORS.†

William Edward McClintock, *Instructor in Highway Engineering.*
Denman Waldo Ross, Ph.D., *Lecturer on the Theory of Design.*
Alphonse Brun, S.B., A.M., *Instructor in French.*
George Sharp Raymer, A.B., M.E., *Instructor in Mining.*
Benjamin Rand, Ph.D., *Instructor in Philosophy.*
Edward Robinson, A.B., *Lecturer on Classical Archaeology.*
John Firman Coar, Ph.D., *Instructor in German.*
Alphonse Marin La Meslée, A.M., *Instructor in French.*
Charles Hamilton Ashton, A.M., *Instructor in Mathematics.*
William Vaughan Moses, S.B. *Instructor in Drawing and Machine Design.*
Albert Sauveur, S.B., *Instructor in Metallurgy.*
Eugene Abraham Darling, A.M., M.D., *Instructor in Hygiene.*
Rodney Howard True, Ph.D., *Lecturer in Botany.*
Reginald Aldworth Daly, S.B., Ph.D., *Instructor in Physiography.*
Frank Lowell Kennedy, A.B., S.B., *Instructor in Mechanical Drawing.*
Dickinson Sergeant Miller, Ph.D., *Instructor in Philosophy.*
Joseph William Carr, Ph.D., *Instructor in German.*
Arthur Bowes Frizell, A.B., *Instructor in Mathematics.*
Thomas Hall, Jr., A.B., *Instructor in English.*
John Goddard Hart, A.M., *Instructor in English.*
George Neely Henning, A.M., *Instructor in French.*

* The address of each of the Preachers, during the term of his residence at the University, is No. 1 Wadsworth House.

† This list includes those only who give instruction in courses prescribed for students of the Scientific School.

Edgar William Olive, S.M., A.M., *Instructor in Botany.*

Frederick Law Olmsted, Jr., A.B., *Instructor in Landscape Architecture.*

Martin Mower, *Instructor in Fine Arts.*

Macy Millmore Skinner, Ph.D., *Instructor in German.*

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STUDENTS, 1899–1900.

Achorn, Kendall Lincoln,	1	Hyg.	*Boston.*
Aiken, George Benjamin Franklin,	3	Gen. Sci.	*Ida Grove, Ia.*
Ainsworth, George Raymond,	1	Arch.	*Brookline.*
Aldrich, Raymond Woodberry,	1	Arch.	*Woburn.*
Alexander, Henry James,	3	Civ. Engin.	*W. Somerville.*
Allen, Thomas Ernest,	1	Sci. T.	*Boston.*
Allyn, Philip Morton,	2	Mech. Engin.	*Cambridge.*
Alvord, Earl Barry,	2	Chem.	*Rochester, N. Y.*
Ames, Fred Elijah,	1	Hyg.	*Spencer.*
Andres, Max George,	2	Arch.	*Cambridge.*
Angus, William Jackson,	*S.*	Civ. Engin.	*Chicago, Ill.*
Applegate, William Augustus,	3	Gen. Sci.	*Cambridge.*
Arkin, Louis,	3	Hyg.	*Boston.*
Armstrong, George Peters,	*S.*	Sci. T.	*Belmont.*
Armstrong, William Henry, S.B. (*Boston Univ.*) 1899,	4	Gen. Sci.	*Glasgow, Scotland.*
Attwill, William Henry,	4	Gen. Sci.	*Cambridge.*
Ayer, Edward Melvin,	1	Mech. Engin.	*New Dorchester.*
Ayer, Nathaniel Farwell,	4	Gen. Sci.	*Boston.*
Bach, Milton Jacob,	2	Gen. Sci.	*New York, N. Y.*
Baird, Stewart,	1	Biology.	*Boston.*
Baker, Charles Herbert,	2	Mech. Engin.	*Cambridge.*
Baker, Harold Woods,	1	Hyg.	*Auburndale.*
Bancroft, Joseph Bubier, 2d,	1	Gen. Sci.	*Hopedale.*
Barber, William,	*S.*	Arch.	*Colorado Springs, Colo.*
Barnes, Robert Coolidge,	2	Mech. Engin.	*Somerville.*
Bassett, William Austin,	3	Civ. Engin.	*Dorchester.*
Batten, Rollin Morgan,	1	Hyg.	*Montclair, N.J.*
Beal, Albert Reynolds,	1	Gen. Sci.	*New York, N. Y.*
Bedford, Russell Booth,	2	Gen. Sci.	*Brooklyn, N. Y.*
Beebe, Silas Palmer, S.B. (*Northern Indiana Normal*) 1896,	4	Gen. Sci.	*St. Johns, Mich.*
Belden, George Frederick,	*S.*	Elec. Engin.	*San Francisco, Cal.*
Benedict, Ralph P,	2	Gen. Sci.	*Trenton, Neb.*
Berry, John George,	3	Gen. Sci.	*Cambridge.*
Beyer, George Westcott,	1	Elec. Engin.	*Charlestown.*
Biddle, Nicholas,	3	Gen. Sci.	*Berkeley Springs, W. Va.*
Bill, Carroll Meredith,	*S.*	Arch.	*Boston.*
Bingham, Harold Whitney,	1	Gen. Sci.	*Chicago, Ill.*

Blake, Robert Fulton,	1	Mech. Engin.	*Boston.*
Boal, Walter Ayres,	4	Gen. Sci.	*Chicago, Ill.*
Boutwell, Horace Keith,	4	Hyg.	*Cambridge.*
Bowerman, Warren Dennison,	2	Gen. Sci.	*New York, N. Y.*
Bowie, John Hughes,	1	Hyg.	*Gardiner, Me.*
Boylston, Herbert Melville,	1	Chem.	*Brooklyn, N. Y.*
Bragdon, William Badeau,	*S.*	Arch.	*New York, N. Y.*
Bramhall, Otis Horton,	1	Sci. T.	*Cambridge.*
Bray, William Madison,	1	Gen. Sci.	*Oshkosh, Wis.*
Bridgman, Harry Vincent,	2	Gen. Sci.	*Boston.*
Bronson, Charles Webb,	4	Mining.	*Fort Scott, Kan.*
Brooks, Walter Denison,	1	Gen. Sci.	*Milton.*
Brower, Jay Jeremiah, M.E. (*Bloomsburg State Normal School*) 1889,	2	Gen. Sci.	*Bloomsburg, Pa.*
Brown, Holcombe James,	2	Gen. Sci.	*New York, N. Y.*
Brown, Paul Ferrie,	2	Elec. Engin.	*Cambridge.*
Brown, Samuel Bronson,	1	Elec. Engin.	*Schenectady, N. Y.*
Brown, Thomas Dalton,	2	Gen. Sci.	*Boston.*
Browne, Percy Corbett,	2	Geol.	*Roxbury.*
Brush, Edwin Marin,	3	Gen. Sci.	*Brookline.*
Buckland, Frank Merton,	4	Gen. Sci.	*W. Hartford, Conn.*
Bunton, George Herbert,	4	Mech. Engin.	*Cambridge.*
Burchenal, Charles Day,	*S.*	Elec. Engin.	*Boston.*
Burden, Arthur Scott,	1	Gen. Sci.	*New York, N. Y.*
Burgess, Herbert Rodney,	1	Gen. Sci.	*Montclair, N. J.*
Burke, Albert Gallatin, Jr.	1	Mech. Engin.	*Batavia, Ill.*
Burnett, Francis Lowell,	3	Hyg.	*Cambridge.*
Burnham, Leroy Pearl,	2	Arch.	*Waltham.*
Burns, Harry Carlton,	2	Arch.	*Boston.*
Burns, James Denniss, Jr.	*S.*	Civ. Engin.	*Salem.*
Burr, Freeman Foster,	4	Gen. Sci.	*Malden.*
Butler, Merrill Philip,	1	Gen. Sci.	*Newton Centre.*
Campbell, Arthur Roy,	1	Sci. T.	*Cambridge.*
Campbell, David Colon,	2	Hyg.	*Cambridge.*
Campbell, George Peter,	4	Sci. T.	*Cambridge.*
Carlton, Frank Carr,	*S.*	Hyg.	*Salem.*
Carroll, Howard Hastings,	2	Gen. Sci.	*Newton.*
Carson, James Oakley,	2	Gen. Sci.	*Geneva, Ill.*
Carstairs, James, Jr.	1	Gen. Sci.	*Philadelphia, Pa.*
Carter, Frank Clifford,	2	Chem.	*Reading.*
Chapin, Allen Granger,	1	Elec. Engin.	*Somerville.*
Chapman, Waldo Ernest,	1	Arch.	*Roxbury.*

Chase, Daniel Downs,	1	Gen. Sci.	*Cambridge.*
Chase, Julian Dwight,	2	Mech. Engin.	*Dedham.*
Chickering, Tileston,	2	Civ. Engin.	*Milton.*
Clark, Edward Nathaniel,	1	Mech. Engin.	*Natick.*
Clark, Francis Lyman,	3	Arch.	*Brookline.*
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Clark, John Donovan,	3	Hyg.	*Newtonville.*
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Clark, William Moulton,	1	Mining.	*Ansonia, Conn.*
Clarkson, Walter,	*S.*	Mining.	*Cambridge.*
Clokey, Ira Waddell,	1	Mining.	*Decatur, Ill.*
Cobb, John Candler, Jr.	1	Mech. Engin.	*Milton.*
Coffin, Francis Parkman,	1	Gen. Sci.	*Brookline.*
Colby, Frederick Bronson,	1	Gen. Sci.	*Baltimore, Md.*
Coleman, Francis Hamilton,	1	Civ. Engin.	*Dorchester.*
Coleman, Lockett Gwin,	3	Mech. Engin.	*New York, N. Y.*
Collier, Guy Bain,	3	Gen. Sci.	*Kinderhook, N. Y.*
Collins, Paul,	1	Civ. Engin.	*Brookline.*
Converse, Joseph Henry, 2d,	2	Hyg.	*Brookline.*
Coolidge, Joshua Warren,	3	Mech. Engin.	*Watertown.*
Coxe, Edmund James Drifton,	1	Mining.	*Drifton, Pa.*
Cram, Ernest Roby, A.B. 1896,	*S.*	Gen. Sci.	*Cambridgeport.*
Crimmins, Thomas,	3	Gen. Sci.	*New York, N. Y.*
Crosse, Shirley Robbins,	2	Elec. Engin.	*Marshfield Hills.*
Crowell, Charles Augustus, Jr.	2	Biology.	*Everett.*
Cudahy, Edward Ignatius,	1	Gen. Sci.	*Chicago, Ill.*
Cunniff, Bernard,	1	Mining.	*Boston.*
Daudt, Otto Armin,	3	Chem.	*St. Charles, Mo.*
Davis, Charles Claflin,	3	Gen. Sci.	*Boston.*
Davis, Gilbert Franklin,	3	Civ. Engin.	*Windsor, Vt.*
Davol, Frank Herbert, Jr.	1	Mech. Engin.	*Brooklyn, N. Y.*
Dean, Benjamin Whitney,	2	Gen. Sci.	*E. Concord, N. H.*
Deland, Benjamin,	1	Mining.	*Springfield.*
Derby, Charles Henry,	1	Sci. T.	*Worcester.*
Derby, John Griswold,	*S.*	Civ. Engin.	*Newport, R. I.*
DeWolfe, Loran Arthur,	*S.*	Sci. T.	*Upper Rawdon, N. S.*
Dexter, Fred Fay,	*S.*	Hyg.	*Springfield.*
Diaz, Manuel de, A.B. (*Univ. of Havana*) 1890, S.B. (*Harvard Univ.*) 1899,	5	Civ. Engin.	*Matanzas, Cuba.*

Dibblee, Benjamin Harrison, A.B. 1899,	4	Mining.	*Ross, Cal.*
Dinsmoor, William Parry Jones,	4	Gen. Sci.	*Keene, N. H.*
Dixon, William Warren,	4	Gen. Sci.	*Chicago, Ill.*
Dodge, Albert, Jr.	2	Mining.	*Gloucester.*
Dodge, Harry Crane,	*S.*	Chem.	*Woburn.*
Doe, Ernest Irvin,	2	Mech. Engin.	*Waltham.*
Doherty, William Oliver,	2	Civ. Engin.	*Marblehead.*
Donham, Albert Grenville,	3	Hyg.	*Portland, Me.*
Donk, Marion Gylbert, A.B. (*Florida Agric. Coll.*) 1898,	4	Gen. Sci.	*Tallahasse, Fla.*
Dorr, Richard Charles,	1	Elec. Engin.	*Worcester.*
Downs, Daniel Frederick,	2	Gen. Sci.	*Brooklyn, N. Y.*
Downs, Ira Bertine,	1	Gen. Sci.	*Brooklyn, N. Y.*
Drown, Richard Wiggin,	2	Mech. Engin.	*Lynn.*
DuBois, Delafield,	1	Gen. Sci.	*New York, N. Y.*
Dudley, Benjamin William,	*S.*	Hyg.	*Lexington, Ky.*
Dudley, Harry Chittenden,	2	Mining.	*Guilford, Conn.*
Dudley, John Charles,	1	Elec. Engin.	*Wilkinsonville.*
Duncan, Samuel White, A.B. (*Brown Univ.*) 1895,	3	Geol.	*Brookline.*
Dustin, George Henry,	4	Mech. Engin.	*Somerville.*
Dutton, Charles Henry,	2	Civ. Engin.	*Chelmsford.*
Dutton, Leland Turner,	2	Chem.	*Watertown.*
Eames, Horace Lovell,	1	Civ. Engin.	*Washington, Conn.*
Earle, Raymond Bartlett,	4	Gen. Sci.	*Newton.*
Eaton, William Dearborn,	2	Civ. Engin.	*Revere.*
Edgerton, Frederick William,	1	Sci. T.	*New London, Conn.*
Edwards, Alfred Thomas,	1	Elec. Engin.	*Annisquam.*
Edwards, Edmund Baker, A.B. 1898,	4	Mech. Engin.	*Milton.*
Eichorn, Frederic Herbert,	2	Civ. Engin.	*Boston.*
Eldridge, Stanley Hall,	3	Gen. Sci.	*Jamaica Plain.*
Ellis, Shirley Gregory,	2	Gen. Sci.	*Lynn.*
Ely, William Brewster,	1	Gen. Sci.	*Newton.*
Emery, Augustus Bachelder,	2	Mining.	*Kansas City, Mo.*
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Fish, Pierce Lovering,	3	Gen. Sci.	*Taunton.*
Flanders, Henry Alexander,	3	Gen. Sci.	*Melrose.*

Floyd, Charles Harold,	1	Arch.	*Milton.*
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Forsman, Stanton Watson,	3	Gen. Sci.	*Williamsport, Pa.*
Foster, Gerard Skaats,	1	Gen. Sci.	*Utica, N. Y.*
Foster, John Winthrop,	1	Gen. Sci.	*Brookline.*
Fox, Austen Hoppin,	1	Gen. Sci.	*New York, N. Y.*
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Gerry, Robert Livingston,	3	Gen. Sci.	*Newport, R.I.*
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Greenlaw, Ralph Weller,	2	Gen. Sci.	*Dedham.*
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Hackley, Joseph George, S.B. (*Centre Coll.*) 1895, S.M. (*ibid.*) 1899,	3	Elec. Engin.	*Danville, Ky.*
Hager, William Perry,	3	Gen. Sci.	*So. Deerfield.*
Hakes, Otto Fitzalan,	3	Mech. Engin.	*Topeka, Kan.*
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Hatch, Cyril Henry,	4	Gen. Sci.	*Newport, R.I.*
Hatch, Ralph Augustus,	1	Hyg.	*Ipswich.*
Haught, Thomas William, A.B. (*Univ. of W. Virginia*) 1896,	1	Elec. Engin.	*Conaway, W. Va.*
Hawkes, Nathan Douglas,	*S.*	Mining.	*Saugus.*
Hawks, Arthur Stearns,	3	Mech. Engin.	*Bardwell's Ferry.*
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Henneberry, George Francis,	1	Gen. Sci.	*Chicago, Ill.*
Herr, Irving,	2	Mining.	*Oak Park, Ill.*
Hersey, Walter Albert,	*S.*	Hyg.	*Wellesley Hills.*
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Hewitt, Morgan Francis,	2	Gen. Sci.	*Menasha, Wis.*
Hibbard, Leonard James,	*S.*	Elec. Engin.	*Northampton.*
Hills, Leon Clark,	*S.*	Mech. Engin.	*Ansonia, Conn.*
Hills, Oliver Sydney,	*S.*	Elec. Engin.	*Ansonia, Conn.*
Hitchings, Frederic Wade,	3	Hyg.	*Dedham.*
Hodges, William Joseph,	1	Elec. Engin.	*Newton Centre.*
Holbrook, Harold Edwin,	1	Biology.	*Milwaukee, Wis.*
Holiday, Francis Erastus, B.S.D. (*Warrensburg State Normal*) 1888,	*S.*	Gen. Sci.	*Warrensburg, Mo.*
Holmes, George Ennis,	3	Mech. Engin.	*Haverhill.*
Horgan, John Dennis,	2	Gen. Sci.	*Dorchester.*
House, Herbert Bissell,	1	Civ. Engin.	*So. Manchester, Conn.*
Howe, Reginald Heber, Jr.	*S.*	Biology.	*Brookline.*
Howes, Donald Winthrop,	1	Gen. Sci.	*Newton.*
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Humphrey, Campbell,	2	Gen. Sci.	*Brookline.*
Humphrey, George Richardson,	*S.*	Chem.	*Cambridge.*
Hunting, Eugene Nathan,	1	Elec. Engin.	*Plymouth.*
Hurley, John Christopher,	1	Gen. Sci.	*Charlestown.*
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Jackson, Herbert Arnold,	1	Gen. Sci.	*New Haven, Conn.*
Jamieson, William Daniels,	*S.*	Gen. Sci.	*Chicago, Ill.*
Janney, Laurence Aquila,	2	Elec. Engin.	*Washington, D.C.*
Jaynes, Charles William,	3	Gen. Sci.	*Boston.*

Johnson, Richard Croswell,	2	Mech. Engin.	*Cambridge.*
Johnston, John Robert,	1	Biology.	*Jamaica Plain.*
Jones, Frank Lorimer,	2	Civ. Engin.	*Sandwich.*
Joyce, Louis Valentine,	3	Mech. Engin.	*Somerville.*
Judson, Charles Sterling,	*S.*	Mining.	*Ansonia, Conn.*
Kasson, Burt Zelotes,	*S.*	Mining.	*Gloversville, N. Y.*
Keller, Ralph Henshaw,	1	Civ. Engin.	*Newton.*
Kelly, John Vincent,	1	Hyg.	*Newton.*
Kent, Gilbert Ray,	1	Civ. Engin.	*Wollaston.*
Kernan, Robert Peebles,	1	Gen. Sci.	*New York, N. Y.*
Kimball, Arthur Clark,	3	Civ. Engin.	*Lynn.*
Kimball, George Cook,	4	Elec. Engin.	*Boston.*
Kimbrough, James Lloyd,	*S.*	Gen. Sci.	*Muncie, Ind.*
King, Frank Shapley,	*S.*	Gen. Sci.	*W. Somerville.*
King, Harry Daniel,	*S.*	Hyg.	*Springfield.*
Kirmayer, Frank Henry,	4	Sci. T.	*Bridgewater.*
Klein, Eugene Schreiber, A.B. 1899,	3	Arch.	*St. Louis, Mo.*
Klein, Samuel Mark,	2	Gen. Sci.	*Greenfield.*
Knight, Edward Carleton,	2	Sci. T.	*Manchester.*
Knight, William Horatio,	2	Chem.	*Hopedale.*
Knowles, Lucius James,	1	Gen. Sci.	*Worcester.*
Langstroth, Walter,	*S.*	Arch.	*Hampton, N. B.*
Lathrop, Fred Haskins,	2	Civ. Engin.	*Charlestown.*
Lawson, Arnold,	1	Gen. Sci.	*Boston.*
Leatherbee, Clifton Felton,	*S.*	Gen. Sci.	*W. Newton.*
Lent, John DeWitt,	1	Arch.	*Wakefield.*
Lewin, Frank Spalding,	*S.*	Hyg.	*Brooklyn, N. Y.*
Lewis, John Henry, Jr.	*S.*	Gen. Sci.	*Boston.*
Lincoln, Alfred Reynolds,	2	Chem.	*Cambridge.*
Lindsley, Frederic Cleland,	1	Mining.	*Washington, D. C.*
Linehan, Jerome Charles,	1	Civ. Engin.	*Cambridge.*
Lissner, Emanuel, A.B. 1899,	4	Mining.	*Boston.*
Litchfield, Bayard Sands,	1	Gen. Sci.	*Brooklyn, N. Y.*
Locke, Henry Weidemann,	2	Elec. Engin.	*Cambridge.*
Locke, James Pillsbury,	4	Civ. Engin.	*Waltham.*
Long, John William,	*S.*	Mech. Engin.	*Charlestown.*
Low, Josiah Orne,	2	Gen. Sci.	*Brooklyn, N. Y.*
Luscomb, Henry Martin,	2	Gen. Sci.	*Bridgeport, Conn.*
Lynch, Henry Hawley,	1	Gen. Sci.	*Boston.*
Lyon, John Kellogg,	1	Gen. Sci.	*Chicago, Ill.*
McAvity, Allan Getchell,	1	Mech. Engin.	*St. John, N. B.*
McCornick, Lewis Bell,	*S.*	Gen. Sci.	*Salt Lake City, Utah*

Macdonald, Harry Louis,	*S.*	Gen. Sci.	*Salem.*
McDonald, Louis Ronald,	*S.*	Hyg.	*Boston.*
MacDonald, William Henry Vincent,	*S.*	Arch.	*Fall River.*
Macdonald, William Valentine,	1	Hyg.	*Cambridge.*
McElligott, James John Thomas,	3	Civ. Engin.	*Charlestown.*
McGrath, William Henry,	3	Elec. Engin.	*Quincy.*
McIlhenny, Rufus Avery,	*S.*	Chem.	*Avery Island, La.*
McIntosh, Frederick Fleming,	1	Mining.	*Sewickley, Pa.*
McKenna, John Andrew,	1	Mech. Engin.	*Antigonish, N.S.*
McLean, George Samuel Read,	2	Arch.	*Cambridge.*
McNary, Charles Herbert,	4	Elec. Engin.	*Brooklyn, N. Y.*
McNeil, Howard Crichton,	3	Gen. Sci.	*Elgin, Ill.*
Maltby, Charles Edward,	1	Gen. Sci.	*Boston.*
Manning, John Brown,	1	Hyg.	*Wollaston.*
Manning, John Francis,	*S.*	Mining.	*Malden.*
Martin, Kenneth McGeoch,	4	Gen. Sci.	*Milwaukee, Wis.*
Mason, Albert Gardner,	4	Gen. Sci.	*Worcester.*
Mason, Frederic Coolidge,	1	Gen. Sci.	*Worcester.*
Mason, Sydney Russell,	1	Gen. Sci.	*Worcester.*
Mayhew, Osgood Norton,	2	Gen. Sci.	*No. Tisbury.*
Mayo, William Henry,	*S.*	Gen. Sci.	*Boston.*
Mead, Henry Eckert,	1	Mining.	*Somerville.*
Meadowcroft, William,	3	Civ. Engin.	*Cambridge.*
Meylan, George Louis Julien, M.D. (*Univ. of New York*) 1896,	3	Gen. Sci.	*Roxbury.*
Michelson, Albert,	3	Gen. Sci.	*New Rochelle, N. Y.*
Millard, Herbert Eugene, A.B. 1898,	4	Arch.	*Cambridge.*
Millard, Jean Sears,	2	Hyg.	*New York, N. Y.*
Moeller, Edward Heine,	1	Arch.	*Buffalo, N. Y.*
Moline, Charles,	4	Hyg.	*Sunderland.*
Monks, Archibald,	1	Mech. Engin.	*Brookline.*
Moore, Henry Bailey,	4	Elec. Engin.	*Yonkers, N. Y.*
Moore, Ralph Spencer,	4	Gen. Sci.	*Cambridge.*
Moore, William Addison,	3	Elec. Engin.	*Toronto, Can.*
Morrill, Charles Henry,	4	Elec. Engin.	*St. Louis, Mo.*
Morse, Arthur Holmes,	3	Mech. Engin.	*Oxford, Me.*
Mortland, Walter Guy,	*S.*	Gen. Sci.	*Allegheny City, Pa.*
Moses, Edmund Quincy,	2	Mech. Engin.	*Waltham.*
Moses, Herbert Wallis,	4	Elec. Engin.	*Chelsea.*
Mueller, Omar Eugene,	1	Gen. Sci.	*Cleveland, O.*

Mumford, Gurdon Saltonstall,	2	Gen. Sci.	*New York, N. Y.*
Murphy, Foye Melvin,	1	Sci. T.	*Portland, Me.*
Murray, John Hennessey,	1	Mech. Engin.	*Cambridge.*
Muzzey, Herbert Sprague,	*S.*	Arch.	*Cambridge.*
Nash, Howard Patterson,	3	Gen. Sci.	*Ridgefield, Conn.*
Nason, Robert Bray,	2	Gen. Sci.	*Brownville, Me.*
Neal, George Franklin,	2	Mining.	*Brockton.*
Nichols, Melville Terry,	2	Civ. Engin.	*Haverhill.*
Nichols, Walter Standish,	1	Elec. Engin.	*Newark, N.J.*
Nickerson, William Gifford,	*S.*	Gen. Sci.	*Dedham.*
Norton, Clifford,	4	Civ. Engin.	*Everett.*
Notman, Arthur,	1	Gen. Sci.	*Brooklyn, N. Y.*
Notman, Howard,	1	Gen. Sci.	*Brooklyn, N. Y.*
Noyes, Arthur Wallace,	1	Chem.	*Gardner.*
Noyes, Gordon August,	*S.*	Gen. Sci.	*Boston.*
Nute, Albert James,	4	Hyg.	*Winthrop.*
Otis, Wilbur Corthill,	1	Mech. Engin.	*Cambridge.*
Page, John Hickok,	4	Mech. Engin.	*Rutland, Vt.*
Page, Logan Waller,	*S.*	Mech. Engin.	*Richmond, Va.*
Parker, Ethelbert,	1	Mech. Engin.	*Cambridge.*
Parker, Gurdon Saltonstall,	3	Arch.	*Cambridge.*
Parker, Lewis Clifford,	1	Chem.	*Lunenburg, N. S.*
Parsons, Ernst Mey,	1	Arch.	*Boston.*
Patterson, Harold Truesdel,	*S.*	Gen. Sci.	*Arlington Heights.*
Peirce, Royal Kellum,	2	Mech. Engin.	*Somerville.*
Penhallow, Dunlap Pearce,	1	Hyg.	*Montreal, Can.*
Perham, David,	3	Arch.	*Chelmsford.*
Perry, John Prince Hazen,	1	Civ. Engin.	*New York, N. Y.*
Persons, Clair George,	1	Sci. T.	*Cambridge.*
Pettit, Townsend Baldwin,	1	Gen. Sci.	*Hempstead, N. Y.*
Pew, Harry Gerard,	1	Gen. Sci.	*Gloucester.*
Peyton, Hamilton Howe,	3	Elec. Engin.	*Duluth, Minn.*
Phelps, Gouverneur Morris,	2	Gen. Sci.	*New Rochelle, N. Y.*
Phipps, Harrie Jean,	1	Mech. Engin.	*Watertown.*
Pierce, Hugh Clay,	4	Gen. Sci.	*Buffalo, N. Y.*
Piper, William Thomas,	1	Mech. Engin.	*Bradford, Pa.*
Pollak, Robert Raphael,	2	Civ. Engin.	*Montgomery, Ala.*
Poor, Frederic Hedge,	1	Elec. Engin.	*Morristown, N. J.*
Pope, Frederick,	*S.*	Elec. Engin.	*Cambridge.*
Pope, Niran Bates,	*S.*	Mech. Engin.	*Cambridge.*
Porter, Augustus Granger,	2	Gen. Sci.	*Niagara Falls, N. Y.*
Pownall, William Arthur,	2	Mech. Engin.	*Waltham.*
Presby, George Watson,	4	Gen. Sci.	*Malden.*

Proctor, Thomas Emerson, A.B. 1895,	*S.*	Arch.	*Boston.*
Pruyn, Robert Dunbar,	1	Gen. Sci.	*Albany, N. Y.*
Pultz, John Leggett,	1	Geol.	*New York, N. Y.*
Pumpelly, Raphael Welles,	1	Gen. Sci.	*Newport, R.I.*
Randolph, Theodore Fitz,	1	Mech. Engin.	*Morristown, N. J.*
Reed, Carlisle,	1	Hyg.	*Boston.*
Reed, Frank Nutting,	2	Gen. Sci.	*Cambridge.*
Reilly, William Griffin,	2	Mech. Engin.	*Watertown.*
Rice, Frederick Ellis,	1	Civ. Engin.	*Brookline.*
Richards, Francis Gragg,	2	Mining.	*Dedham.*
Richards, Oliver Filley,	4	Gen. Sci.	*St. Louis, Mo.*
Richardson, Enos Stanley Thomas,	1	Gen. Sci.	*Brooklyn, N. Y.*
Ristine, Albert Welles,	*S.*	Mining.	*Fort Dodge, Ia.*
Ritchie, Nelson Grant,	2	Gen. Sci.	*Asbury Park, N.J.*
Robbins, Isaac David,	1	Sci. T.	*Dorchester.*
Robinson, Charles Bonnycastle, Jr.	1	Arch.	*Anchorage, Ky.*
Robinson, Thomas Russell,	3	Arch.	*Dedham.*
Roche, John A, Jr.	1	Gen. Sci.	*Chicago, Ill.*
Rock, Alfred Mayer,	3	Geol.	*Washington, D.C.*
Rockwell, Albert John,	4	Gen. Sci.	*Warren, Pa.*
Rockwell, Samuel Forbes,	4	Mech. Engin.	*Pittsfield.*
Rollins, Ashton,	1	Land. Arch.	*Boston.*
Roloson, Robert Marshall,	2	Gen. Sci.	*Chicago, Ill.*
Rosenfeld, Herbert Abraham,	1	Gen. Sci.	*New York, N. Y.*
Ross, John McCombs,	2	Gen. Sci.	*Cleveland, O.*
Rossiter, Frank Heath,	2	Gen. Sci.	*New York, N. Y.*
Rotch, William, Jr.	3	Elec. Engin.	*Jamaica Plain.*
Rothschild, Monroe Reese,	3	Gen. Sci.	*Chicago, Ill.*
Ruhl, Robert Waldo,	1	Gen. Sci.	*Rockford, Ill.*
Runnells, Clive,	2	Gen. Sci.	*Chicago, Ill.*
Russell, George Henry,	*S.*	Hyg.	*Cambridge.*
Safford, Ralph Kirkham,	*S.*	Gen Sci.	*Springfield.*
Sawin, George Alfred,	3	Elec. Engin.	*Cambridge.*
Sayward, Perceval,	*S.*	Gen. Sci.	*Dorchester.*
Schwill, Julius Orrin,	1	Gen. Sci.	*Cincinnati, O.*
Scott, Charles Raymond,	*S.*	Arch.	*Cambridge.*
Sewall, Otis Prescott,	1	Gen. Sci.	*New York, N. Y.*
Shapleigh, Rogers Wentworth,	1	Gen. Sci.	*Newton.*
Shaughnessy, Charles Stephen,	3	Civ. Engin.	*Ashland.*
Shepard, Frederick Mead,	1	Elec. Engin.	*Fanwood, N. J.*
Shepard, Frederick Stanley,	1	Sci. T.	*Chelsea.*

Shertzer, Tyrrell Bradbury,	4	Civ. Engin.	*Baltimore, Md.*
Shipman, William Wade,	*S.*	Mining.	*Manchester, N.H.*
Shirk, Elbert Walker,	2	Gen. Sci.	*Peru, Ind.*
Shore, Howard Everett, A.B. 1899,	3	Civ. Engin.	*Philadelphia, Pa.*
Shreve, Henry Mason,	1	Gen. Sci.	*Salem.*
Shute, Bruce Thurber,	*S.*	Gen. Sci.	*Chicago, Ill.*
Singer, Sidney Kent,	2	Chem.	*Chicago, Ill.*
Smith, Arthur Morgan,	1	Gen. Sci.	*Quincy, Ill.*
Smith, Albert Ross,	4	Mech. Engin.	*Chelsea.*
Smith, Edwin Hammett,	3	Civ. Engin.	*Chelsea.*
Somers, Laurence Drew,	1	Mining.	*Brookline.*
Somes, John Edward, Jr.	3	Arch.	*Gloucester.*
Spear, LeRoy Freeman,	1	Hyg.	*Walpole.*
Sprague, Edward Buell,	1	Gen. Sci.	*Flushing, N. Y.*
Sprague, Percy Theodore,	*S.*	Elec. Engin.	*Watertown.*
Stark, Charles Wolcott,	1	Civ. Engin.	*Penn Yan, N. Y.*
Starr, William Thompson,	1	Civ. Engin.	*Indiannapolis, Ind.*
Stebbins, Roland Williams,	4	Mech. Engin.	*Springfield.*
Stetson, Henry Niebuhr,	1	Gen. Sci.	*St. John, N.B.*
Stevens, Sidney,	4	Mech. Engin.	*Ludlow.*
Stevenson, Charles Royal,	2	Gen. Sci.	*Buffalo, N. Y.*
Streit, Raymond Eugene,	1	Gen. Sci.	*Brooklyn, N. Y.*
Sturgis, Arthur,	4	Elec. Engin.	*New York, N. Y.*
Sullivan, Walter,	1	Gen. Sci.	*San Antonio, Tex.*
Swift, Rodman,	1	Mining.	*New Bedford.*
Switzer, Louis Howard,	1	Gen. Sci.	*New York, N. Y.*
Taggart, Howard Ward,	3	Gen. Sci.	*South Orange, N.J.*
Taylor, Brainerd,	1	Hyg.	*Newtonville.*
Taylor, Ralph,	*S.*	Gen. Sci.	*Boston.*
Taylor, Ralph Slater,	1	Gen. Sci.	*Melrose Highlands.*
Taylor, William Edward, Jr.	1	Chem.	*Pittsburg, Pa.*
Taylor, William Nicholson,	1	Arch.	*Pittsburg, Pa.*
Terbush, Myron Emmet,	4	Elec. Engin.	*South Owego, N. Y.*
Tevis, Robert,	1	Gen. Sci.	*Louisville, Ky.*
Thayer, Cranston Swift,	4	Elec. Engin.	*Cambridge.*
Thayer, Farwell Edward, A.B. 1899,	3	Arch.	*Cambridge.*
Thayer, Nathaniel Augustine,	2	Civ. Engin.	*Wollaston.*
Thomas, Benjamin Franklin,	1	Civ. Engin.	*San Francisco, Cal.*
Thomas, Egbert Eldridge,	3	Gen. Sci.	*Highland Falls, N. Y.*
Thompson, Marcellus,	1	Gen. Sci.	*Springfield.*
Thurston, Alden Sampson,	1	Gen. Sci.	*New York, N. Y.*
Torossian, Mihran Garabed,	*S.*	Elec. Engin.	*Cesaria, Armenia.*
Torrey, Harry Kimball,	1	Gen. Sci.	*Newfields, N.H.*

Tracy, James Kennard,	1	Chem.	*Brookline.*
Tucker, Herman Franklin,	3	Civ. Engin.	*Kendal Green.*
Van Winkle, Edgar Beach, Jr.	*S.*	Gen. Sci.	*New York, N. Y.*
Vaughan, Frank Apthorp, A.B. 1898,	4	Mech. Engin.	*Cambridge.*
Wadsworth, Lewis Lumber, Jr.	*S.*	Civ. Engin.	*Cambridge.*
Wait, Charles Robert,	1	Arch.	*Wakefield.*
Walker, Charles Wesley Vande,	2	Sci. T.	*Oshkosh, Wis.*
Walker, Chester Sargent,	2	Chem.	*Chelsea.*
Walker, Henry Earl,	1	Mech. Engin.	*Vineyard Haven.*
Walker, Robert Salisbury,	2	Civ. Engin.	*Brookline.*
Wallace, Henry Whitney,	3	Gen. Sci.	*Steubenville, O.*
Ward, Howard Ridgely,	1	Gen. Sci.	*New York, N. Y.*
Wardwell, Frank Wellington, Jr.	2	Gen. Sci.	*Cleveland, O.*
Wardwell, Louis Edward,	2	Hyg.	*Camden, Me.*
Warland, William Seaver,	1	Gen. Sci.	*Cambridge.*
Warner, William Skinner,	2	Gen. Sci.	*Dorchester.*
Warren, Leicester,	4	Gen. Sci.	*Cambridge.*
Waterhouse, Harold Pillsbury,	2	Gen. Sci.	*Melrose.*
Waterman, John Slater,	3	Hyg.	*E. Greenwich, R. I.*
Watson, Ralph Hopkins,	4	Mining.	*W. Somerville.*
Watson, Robert Henderson,	2	Gen. Sci.	*Allegheny City, Pa.*
Webster, Ira Gilbert,	1	Mech. Engin.	*New Albany, Ind.*
Weitze, Carl Robert,	1	Civ. Engin.	*Cambridge.*
Weld, Christopher Minot,	2	Mining.	*Jamaica Plain.*
Wells, James Ogden,	3	Gen. Sci.	*St. Joseph, Mich.*
Wesson, Harold,	*S.*	Mech. Engin.	*Springfield.*
Wheeler, Homer Charles,	2	Mech. Engin.	*Peterboro, N. H.*
Wheeler, Henry Hamilton,	2	Hyg.	*Spencer.*
White, Henry Preston, A.B. 1899,	2	Arch.	*Brookline.*
Whitman, Harry Bertram,	1	Gen. Sci.	*Cambridge.*
Whitney, Vincent,	1	Gen. Sci.	*Rocklin, Cal.*
Whiton, Herbert Starkes,	3	Mech. Engin.	*Hingham Centre.*
Whittemore, Wyman,	2	Hyg.	*Providence, R.I.*
Whittier, Edward James,	3	Mech. Engin.	*Boston.*
Wilcock, Frederick,	4	Civ. Engin.	*Brooklyn, N. Y.*
Williams, Edward Cary,	2	Gen. Sci.	*Boston.*
Williams, Henry Trumbull,	1	Mech. Engin.	*Chelsea.*
Williams, John Henry Gardner,	2	Civ. Engin.	*Springfield.*
Williams, Simon Everard, PH.G. (*N. Y. Coll. of Pharmacy*) 1891,	4	Chem.	*Mt. Vernon, N. Y.*
Willis, Ell Newton,	1	Elec. Engin.	*Concord, N. H.*
Wilson, James Arthur,	*S.*	Gen. Sci.	*Dorchester.*

Winter, John Barthol,	2	Elec. Engin.	*Buffalo, N. Y.*
Wiswell, Herbert Joseph,	2	Mining.	*Cambridge.*
Witbeck, Albert Tyler,	*S.*	Civ. Engin.	*Lansingburg, N. Y.*
Wood, William Barry,	1	Gen. Sci.	*Brookline.*
Woods, Charles Royal, Jr.	3	Gen. Sci.	*Cambridge.*
Wright, Augustus Edward,	3	Arch.	*Fayville.*
Wyllys-Pomeroy, Samuel Wyllys, Jr.	1	Civ. Engin.	*Newport, R.I.*
Young, James Herbert,	1	Hyg.	*Amesbury.*

SUMMARY.

Fifth Year Students	1
Fourth " "	60
Third " "	73
Second " "	107
First " "	177
Special "	78
Total	496

Civil Engineering	53
Electrical Engineering	42
Mechanical Engineering	62
Mining Engineering	32
Architecture	35
Landscape Architecture	1
Chemistry	18
Geology	4
Biology	5
Anatomy and Physiology	39
For Teachers of Science	17
General Science	188
Total	496

HOLDERS OF SCHOLARSHIPS

1899–1900.

University.

Louis Arkin.
William Austin Bassett.
Vincent Morse Frost.
John Gaillard.
Arthur Stearns Hawks.
Irving Herr.
Samuel Mark Klein.
Alfred Reynolds Lincoln.
William Meadowcroft.
Arthur Holmes Morse.
William Arthur Pownall.
Charles Stephen Shaughnessy.
Nathaniel Augustine Thayer.
Frederick Wilcock.
Herbert Joseph Wiswell.

Eveleth.

George Peter Campbell.
Charles Henry Dutton.
John Hickok Page.

Hilton.

Homer Charles Wheeler.

Jennings.

Ralph Hopkins Watson.

Normal School.

Silas Palmer Beebe.
Charles Augustus Crowell, Jr.
Francis Erastus Holiday.
Frank Lorimer Jones.
Frank Henry Kirmayer.
Edward Carleton Knight.
Clair George Persons.
Charles Wesley Vande Walker.

DEGREES.

On Commencement Day, June 27, 1900, the degree of S.B. was conferred as follows: —

In Civil and Topographical Engineering.

Alexander, Henry James.
Locke, James Pillsbury.
Norton, Clifford.
Shertzer, Tyrrell Bradbury (*cum laude.*
Wilcox, Frederick (*magna cum laude*).

In Electrical Engineering.

Kimball, George Cook (*cum laude*).
McNary, Charles Herbert (*magna cum laude*).
Moore, Henry Bailey.
Morrill, Charles Henry (*magna cum laude*).
Moses, Herbert Wallis.
Sturgis, Arthur (*magna cum laude*).
Thayer, Cranston Swift (*cum laude*).

In Mechanical Engineering.

Blake, Robert Fulton.
Bunton, George Herbert (*cum laude*).
Dustin, George Henry.
Edwards, Edmund Baker, A.B.
Emery, Manning, Jr.
Harris, Albert.
Harris, Wilbur Andrew.
Hawks, Arthur Stearns.
Hughes, Harold Lincoln (*summa cum laude*).
Page, John Hickok (*summa cum laude*).
Stevens, Sidney (*cum laude*).
Vaughan, Frank Apthorp, A.B. (*magna cum laude*).

In Mining and Metallurgy.

Lissner, Emanuel, A.B.
Watson, Ralph Hopkins (*summa cum laude*).

In Architecture.

Graham, Edward Thomas Patrick (*cum laude*).
Jones, Frederic Marshall, A.B. (*cum laude*).
Parker, Gurdon Saltonstall.

In Chemistry.

Greene, Harry Henderson (*cum laude*).
Williams, Simon Everard, Ph.G. (*magna cum laude*).

In Geology.

Irvin, Effingham Townsend (as of year 1898).

In General Science.

Attwill, William Henry.
Ayer, Nathaniel Farwell.
Beebe, Silas Palmer, S.B. (*magna cum laude*).
Biddle, Nicholas.
Boal, Walter Ayres (*cum laude*).
Buckland, Frank Merton (*cum laude*).
Burr, Freeman Foster (*magna cum laude*).

Crimmins, Thomas.
Dinsmoor, William Parry Jones.
Dixon, William Warren.
Ferguson, Robert Arthur.
Hager, William Perry (*cum laude*).
Harding, Charles Lewis.
Hatch, Cyril Henry.
Horgan, John Dennis.
Martin, Kenneth McGeoch.
Mason, Albert Gardner.
Moore, Ralph Spencer.
Pierce, Hugh Clay.
Presby, George Watson.
Richards, Oliver Filley.
Rockwell, Albert John (*cum laude*).
Terbush, Myron Emmet.
Warren, Leicester.

For Teachers of Science.

Campbell, George Peter (*magna cum laude*).
Kirmayer, Frank Henry (*magna cum laude*).

In Anatomy and Physiology.

Graves, Robert John (*magna cum laude*).
Moline, Charles.
Nute, Albert James (as of year 1899).

THE LAWRENCE SCIENTIFIC SCHOOL.

GENERAL ACCOUNT OF THE SCHOOL.

The Scientific School was instituted by the Corporation and Overseers of Harvard College in February, 1847. It took its present name — Lawrence Scientific School — at the following Commencement, in recognition of a gift of fifty thousand dollars from the Hon. Abbott Lawrence, of Boston. It was opened to students in February, 1848. It was at first announced as an advanced school in Science and Literature for graduates and other sufficiently qualified persons of not less than eighteen years of age, and was, therefore, in its origin, a forerunner of the Graduate School. Most of its early students were college graduates or men of mature age who came to the School for the professional study of a special subject. The instruction originally proposed in Literature was, however, never organized. It is now a school which receives suitably prepared graduates of secondary schools, as well as older students, and offers chiefly training in the various branches of natural and applied science. Its students may attain the degree of Bachelor of Science.

The Lawrence Scientific School, together with Harvard College and the Graduate School, is under the control of the Faculty of Arts and Sciences of Harvard University. The instruction in these departments is given by the same teachers, mostly in classes which may be attended by pupils from any one of these schools. The life of the students in all three departments is in common; they share alike in all the advantages which the academic department of the University can afford them. So far as their plans may make it desirable, they are allowed, without additional charge, to attend lectures in the professional schools of the University.

The essential peculiarity of the Scientific School, as compared with the other schools which are managed by the Faculty of Arts and Sciences, is that the instruction which it provides for its students is, for the most part, arranged in groups of definitely required courses, each of which is intended to afford, in a four years' course of study, the training necessary for one of the scientific professions, such as Engineering, Chemistry, Geology, etc. While, with the consent of the Administrative Board of the School, slight changes may be made in the prescribed studies in order to meet the particular needs of the individual student, the plan of these courses leading to the degree of Bachelor of Science must in general be adhered to.

Students attending the School may lodge in the dormitories or in private houses, a list of which will be sent on application to the Secretary. They may take their meals in Memorial Hall, which affords accommodation for about 1100 persons; or in Randall Hall, which provides for about 800; or in private boarding houses.

ADVISER.

Each student in the Scientific School has one of its officers designated as his adviser, to whom he is to look for counsel concerning the conduct of his studies and for such other assistance as he may need during his residence at the University.

INSTRUCTION IN OTHER DEPARTMENTS OF THE UNIVERSITY.

All students of the Scientific School may, if found competent, pursue any of the courses of instruction given in the other departments of the University, except exercises carried on in the special laboratories, without additional charge, but this provision does not apply to Special Students unless they pay the full tuition fee of $150.

REGULATIONS CONCERNING ADMISSION TO THE SCHOOL.

Examinations.

A student who wishes to enter the Lawrence Scientific School as a candidate for a degree must ordinarily pass an examination for admission; but if he comes from another college or scientific school, he may be admitted without examination (see page 41).

Special Students, that is, students not candidates for a degree, are admitted without examination (see page 42).

Examinations for admission to the Lawrence Scientific School are held in June both at Cambridge and at the places named on pages 69, 70; in September they are held at Cambridge only. For the regulations concerning the division of the examination into a Preliminary and a Final Examination taken in two different years, or — in the case of a student who takes the whole examination in *one* year — the division of the Final Examination between June and September of that year, see pages 40, 41.

For the hours set for examinations, see pages 71, 72.

The requirements for admission are stated on pp. 43, 44.

The definitions of the subjects in which admission examinations are held are given on pp. 45–68.

Testimonials.

Every candidate for admission to the Lawrence Scientific School is required to furnish a testimonial of honorable dismissal from the school or college which he has attended, or from the tutor with whom he has studied. Testimonials may be presented at the time of the Final Examination. When a candidate has been in regular attendance at a school or academy for any part of the year preceding his Final Examination, a testimonial from a private tutor is not in itself sufficient.

Certificates of Preparation.

Every candidate for a Preliminary Examination must present a certificate of preparation in the subjects in which he offers himself. (For the prescribed form of these certificates, see page 40.)

No certificate of preparation is required of a candidate for a Final Examination, even when the candidate divides his examination between June and September of one year.

Required Notice of Place of Examination.

Candidates who wish to be examined in any place other than Cambridge are required to give notice to the Corresponding Secretary of Harvard University, or to the Secretary of the School. The notice must be in the Secretary's hands not later than *June 10*. Candidates who intend to take any of the examinations of the first day must mention this intention in the notice. No notice is required from candidates who intend to be examined in Cambridge.

Examination Fees.

No fee is charged for examination in Cambridge.

A fee of five dollars must be paid *in advance* by every candidate who is examined at any place other than Cambridge. The whole fee of a candidate who purposes to divide his examination is to be paid before his first examination: it should be sent by check, post-office order, or registered letter, to Mr. Charles F. Mason, Bursar, Dane Hall, Cambridge, Mass., and should be in the Bursar's hands not later than *June 20*.

Persons who do not intend to enter the University will be admitted to the examintions at places other than Cambridge on payment of a fee of five dollars; and, if successful in fulfilling the requirements for admission to the Lawrence Scientific School, will receive certificates tc that effect.

Division of the Examination.

A candidate for admission to the Lawrence Scientific School may take the entire examination at one time; or he may divide it, under the following conditions, (1) between two years, or (2) between June and September of the same year. If he divides it between two years, he is known as a "Preliminary Candidate"; if between June and September of the same year, as a "Postponing Candidate." Teachers and candidates should carefully distinguish between the words "Preliminary" and "Postponing," as used at examinations for admission, since a careless use of one of these words for the other may lead to serious misunderstanding. A Preliminary Examination is always taken a year or more before the Final Examination. Postponing Candidates, whether in September or in June, are taking Final Examinations.

If a study *under the old definitions* consists of two parts, designated by the letters (*a*) and (*b*), the examinations in those parts may be taken separately by a candidate who divides his examinations for admission either between two years or between June and September of the same year. No other study may be divided.

Under the new definitions, in each study numbered in bold-face type (**1**, **2**, **3**, etc.), there is one examination which cannot be divided.

Preliminary Examination.

A candidate may pass a Preliminary Examination in some studies in one year; and, on receiving a Preliminary Certificate, may pass a Final Examination in the remaining studies in some subsequent year. For the Preliminary Examination the candidate is expected to present himself in June, having previously sent in a certificate of preparation (see below). No preliminary Candidate for the Scientific School will be examined in September without special permission from the Dean of the Scientific School.

Candidates may offer themselves for the Preliminary Examination in any studies, Elementary or Advanced, *in which their teachers certify that they are prepared, and in no others.*

Teacher's Certificate of Preparation.

The certificate of preparation for a Preliminary Candidate must be in the following form: —

"..... has been my pupil for ..... years, and is, in my judgment, prepared to pass the Harvard Preliminary Examination in the following studies (or subjects): — . . . .
Name of Teacher: ..... Name of School: ..... Address: ....."

When a candidate has been in regular attendance at a school or academy, for any part of the year preceding his Preliminary Examination, his certificate must be signed by the principal of that school or academy.

The certificates of Preliminary Candidates to be examined in Cambridge must be in the hands of the Secretary of the Scientific School, on or before *June 21;* those of Preliminary Candidates who wish to be examined elsewhere, on or before *June 14.*

Preliminary Certificates.

In granting Preliminary Certificates each case will be considered on its merits, but usually a Certificate will not be granted unless the candidate has passed in subjects aggregating at least six points.

Postponed Examination.

A candidate who presents himself in June intending to pass the whole examination in the same year may, under certain conditions, postpone a part of his examination until September. Such a candidate must register in June not as a *Preliminary* but as a *Final* candidate.

A Postponing Candidate for admission to the Scientific School will receive no credit for the examination held in June, unless he passes then in subjects aggregating at least six points.

Admission to Advanced Standing.

A candidate may be admitted to advanced standing either by passing examinations in all the studies already pursued by the class for which he offers himself, in addition to all the entrance examinations; or, from another scientific school or college upon such conditions as the Committee on Admission from other Colleges and Scientific Schools may deem equitable in each case, regard being had to the applicant's previous course of study, and to the evidence of proficiency exhibited by him; but the Scientific School degree is not conferred without at least one full year's work as a registered student in the School. (See page 79.)

Persons who wish to enter the School with Advanced Standing will be furnished with printed forms of application by the Secretary of the School. This form must be filled out and returned to the Secretary before the application will be considered by the Committee.

See, also, conditions of candidacy for degrees, p. 79.

Admission of Special Students.

The courses of study provided by the Faculty of Arts and Sciences are open to persons who give satisfactory evidence of their fitness to pursue the particular courses they elect, although they have not passed the usual examinations for admission. These students are known as Special Students; they are members of the Scientific School from the time of their admission, but are not recognized as in regular standing or as candidates for a degree.

A candidate for admission to the Lawrence Scientific School as a Special Student may obtain a printed form of application from the Secretary of the School. The form must be filled out and returned to the Secretary before the application will be considered by the Administrative Board of the School.

Candidates who cannot otherwise show that they are competent to pursue subjects which are protected by entrance examinations must pass satisfactory tests before entering these courses. Exceptional cases may be referred to the Administrative Board by petition.

At the beginning of each year, Special Students in the Scientific School must submit their choice of studies for approval to the Administrative Board. They are required to take each year at least four full courses of instruction selected from those in Mathematics, Engineering, Physics, Chemistry, Geology, Botany, or Zoölogy, or from courses in other subjects which enter into the several programmes of study offered in the School.

At least two full courses of the work of each Special Student in the Scientific School must be taken from the regular programme of the Department of Study in which he registers.

Special Students are subject to all the regulations of the School. A report is sent to their parents or guardians at the end of each year.

The Administrative Board reserve the right to deprive any Special Student of his privileges at any time, if he abuse or fail to use them.

A Certificate of Proficiency will be given, if desired, to any Special Student who has faithfully pursued his chosen subjects throughout a year and attained a grade not lower than Grade *B* therein.

REQUIREMENTS FOR ADMISSION.

The scheme of admission requirements which was recently adopted and which will be in complete operation in 1903, contemplates bringing the requirements up to equality with those of Harvard College by adding new subjects from year to year.

In those studies which may be used for admission either to Harvard College or to the Scientific School, the examinations will be identical, a fixed examination being held in each study for all candidates who offer themselves in that study.

The studies which may be presented in satisfaction of the requirements for admission to the Lawrence Scientific School are named in the following list, and are defined on pages 45–68.

The figure attached to each study indicates the relative weight (termed *points*) which will be given to it in determining the question of the candidate's fitness for admission.

Elementary	*Advanced.*
English (*4*)	
Greek (*4*)	Greek (*2*)
Latin (*4*)	Latin (*2*)
German (*2*)	German (*2*)
French (*2*)	French (*2*)
	One of the following four: —
Greek and Roman History (*2*), *or*	Greek and Roman History (*2*)
English and American History (*2*)	English and American History (*2*)
	History of Europe (*2*)
	History of a period (*2*)
Algebra (*2*)	Algebra (*1*)
Geometry (*3*), *or*	Logarithms and Trigonometry (*1*)
Plane Geometry (*2*)	*Analytic Geometry (*1*)
Solid Geometry (*1*)	
Physics (*2*)	Physics (*2*)
Chemistry (*2*)	Meteorology (*1*)
Physiography (*1*)	Astronomy (*1*)
Anatomy, Physiology & Hygiene (*1*)	
Botany (*1*)	
Zoölogy (*1*)	
Drawing, { Freehand (*1*) / Projections (*1*) }	
Shopwork, { Wood-working (*1*) / Blacksmithing (*1*) / Chipping, Filing and Fitting (*1*) / Machine-tool Work (*1*) }	

* In 1900 and 1901.

In 1900 a candidate may satisfy the requirements for admission by passing the examinations in the following studies: —

English	4	*Group A.*
Elementary German	2	
Elementary French	2	
Elementary History	2	
Algebra	2	
Geometry (Plane and Solid)	3	

In addition to the above he will be required to offer: —

Elementary Physics *or* Elementary Chemistry *or* any two of the following studies: — Physiography, Anatomy, Physiology and Hygiene, Zoölogy, Botany, Astronomy	2	*Group A.*
	17	

The above group of prescribed studies, with a total valuation of 17 points, will be called Group *A*.

In addition to the studies of Group *A* the candidate will be required to pass examinations in studies selected from the list given on page 43 aggregating 2 points, making a total of 19 points.

After 1900, it is proposed that the requirements be: —

For 1901, the studies of Group *A*, and studies in addition aggregating 4 points, a total of 21 points;

For 1902, the studies of Group *A*, and studies in addition aggregating 6 points, a total of 23 points;

For 1903, and thereafter, the studies of Group *A*, and studies in addition aggregating 9 points, a total of 26 points.

Advanced German may be offered in place of Elementary French, or Advanced French in place of Elementary German; but when thus displaced the elementary language will become a prescribed study for the first college year.

The requirements in Geometry may be satisfied by passing either in Geometry (*3*), or in Plane Geometry (*2*) and Solid Geometry (*1*).

In the examinations of 1900 and 1901, but not thereafter, *alternative papers* will be offered under the old definitions (where they differ materially from the present definitions) in Greek, Latin, German, French, History, Mathematics, Physics, and Chemistry.

STUDIES IN WHICH EXAMINATIONS ARE HELD.

I. *NEW DEFINITIONS.

Good English.

Clear and idiomatic English is expected in all examination papers and note-books written by candidates for admission. Teachers are requested to insist on good English, not only in translations, but in every exercise in which the pupil has occasion to write or to speak English.

1. English.†

(As heretofore.)

The examination will consist of two parts, which, however, cannot be taken separately: —

I. The candidate will be required to write a paragraph or two on each of several topics chosen by him from a considerable number — perhaps ten or fifteen — set before him on the examination paper. In 1900 ‡ the topics will be drawn from the following works: —

Dryden's Palamon and Arcite; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Scott's Ivanhoe; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal.

The candidate is expected to read intelligently *all* the books prescribed. He should read them as he reads other books; he is expected not to know them minutely, but to have freshly in mind their most important parts. In every case the examiner will regard knowledge of the book as less important than ability to write English.

As additional evidence of preparation, the candidate may present an exercise book, properly certified by his instructor, containing compositions or other written work.

II. A certain number of books will be prescribed for careful study. This part of the examination will be upon subject-matter, literary form, and logical structure, and will also test the candidate's ability to express his knowledge with clearness and accuracy. The books prescribed for this part of the examination in 1900 ¶ are: —

Shakspere's Macbeth; Milton's Paradise Lost, Books I and II; Burke's Speech on Conciliation with America; Macaulay's Essays on Milton and Addison.

* For old definitions, see page 62.

† See, also, pp. 74–76.

‡ See p. 63 for the books prescribed in 1901 and 1902.

¶ See p. 62 for the books prescribed in 1901 and 1902.

No candidate will be accepted in English whose work is seriously defective in point of spelling, punctuation, grammar, or division into paragraphs.

In connection with the reading and study of the prescribed books, parallel or subsidiary reading should be encouraged, and a considerable amount of English poetry should be committed to memory. The essentials of English grammar should not be neglected in preparatory study.

The English written by a candidate in any of his examination-books may be regarded as part of his examination in English, in case the evidence afforded by the examination-book in English is insufficient.

2, 3. Greek.

2. *Elementary Greek.*

The examination will be adapted to the proficiency of those who have studied Greek in a systematic course of five exercises a week, extending through at least *two* school years. The two parts of the examination cannot be taken separately : —

(*a*) The translation at sight of simple Attic prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) A thorough examination on a prescribed portion of Xenophon (about thirty pages*), directed to testing the candidate's mastery of the ordinary forms, constructions, and idioms of the language; the test to consist, in part, of writing simple Attic prose, involving the use of such words, constructions, and idioms only as occur in the portion of Xenophon prescribed.

For four years, beginning with 1898, the portion of Xenophon prescribed will be the second book of the Anabasis.

3. *Advanced Greek.*

The examination will be adapted to the proficiency of those who have studied Greek in a systematic course of five exercises a week, extending through at least *three* school years. The second part of the examination (Greek Composition) is optional, and may be omitted without loss of credit : —

(*a*) The translation at sight of Attic prose and of Homer, with questions designed to test the candidate's understanding of the passages set, and questions on ordinary forms, constructions, and idioms, and on prosody. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into Attic prose of a short passage of connected English narrative. (The passage set for translation will be based on some

* The pages of the more recent Teubner text editions are taken as a standard in this statement.

portion of the Greek prose works usually read in preparation for College, and will be limited to the subject-matter of those works.)

The estimate of the periods of study necessary to prepare for the elementary and advanced examinations in Greek is based on the assumption that the candidate has begun the study of Latin at least a year earlier, and has continued it along with his Greek course; otherwise the periods specified would not be sufficient.

In preparation for the elementary examination in Greek, candidates should read from 130 to 170 pages* of Attic prose. For the advanced examination, candidates should read from 30 to 50 pages more of Attic prose, and from 3000 to 5000 verses of Homer. The reading of Homer may be advantageously begun with a thorough study of Iliad, Books I and II (to the catalogue of ships).

The pupil should be constantly guided in proper methods of reading, and trained to read the Greek intelligently, as Greek, before undertaking to render it into idiomatic English. There should be constant practice in reading aloud, with due expression, and in hearing the language read. In connection with the reading, to ensure thoroughness and accuracy in the pupil's understanding of the language, the study of grammar, with some practice in writing Greek, should be maintained throughout the course. There should also be frequent written translations into idiomatic English.

To prepare for the examination in Greek Composition, pupils should be trained, from an early stage of the preparatory course, to render into Greek, not merely detached sentences, illustrative of constructions, but also passages of connected narrative, prepared by the teacher on the basis of prose authors read.

4, 5. Latin.

4. *Elementary Latin.*

The examination will be adapted to the proficiency of those who have studied Latin in a systematic course of five lessons a week, extending through at least *three* school years. The two parts of the examination cannot be taken separately: —

(*a*) The translation at sight of simple Latin prose and verse. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) A thorough examination on a prescribed portion of Cicero's speeches (about thirty pages*), directed to testing the candidate's mastery of the ordinary forms, constructions, and idioms of the language; the test to consist, in part, of writing simple Latin prose, involving the use of such words, constructions, and idioms only as occur in the speeches prescribed.

For four years, beginning with 1898, the portion of Cicero prescribed will be the second, third, and fourth speeches against Catiline.

* See foot-note, p. 46.

5. *Advanced Latin.*

The examination will be adapted to the proficiency of those who have studied Latin in a systematic course of five lessons a week, extending through at least *four* school years. The two parts of the examination cannot be taken separately: —

(*a*) The translation at sight of Latin prose and verse with questions designed to test the candidate's understanding of the passages set, and questions on ordinary forms, constructions, and idioms, and on prosody. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into Latin prose of a short passage of connected English narrative. (The passage set for translation will be based on some portion of the Latin prose works usually read in preparation for College, and will be limited to the subject-matter of those works.)

The estimate of the periods of study necessary to prepare for the examinations in Latin is made with reference to schools which have a four-years' course. Schools which have a five-years' course may more advantageously provide for beginning the study of Latin in the first year, with some diminution, if necessary, of the time devoted to it in the last years of the course.

The course of reading pursued in preparation for the examinations in Latin should include: —

(*a*) Easy reading, included in or following a suitable introductory book ('Latin Lessons'), amounting to from 30 to 40 pages;*

(*b*) Nepos (Lives) and Caesar (Gallic War), 90 to 120 pages;

(*c*) Cicero, 90 to 120 pages, including the four speeches against Catiline and the speech on the Manilian Law, with additional speeches selected by the teacher;

(*d*) Virgil and Ovid, 6000 to 10,000 verses, including the first six books of the Aeneid.

Preparation for the elementary examination alone should include (*a*) and (*b*), the four speeches against Catiline, and from 2000 to 3000 verses of Virgil, or of Ovid and Virgil.

The pupil should be constantly guided in proper methods of reading, and trained to read the Latin intelligently, as Latin, before undertaking to render it into idiomatic English. There should be constant practice in reading aloud, with due expression, and in hearing the language read. In connection with the reading, to ensure thoroughness and accuracy in the pupil's understanding of the language, the study of grammar, with some practice in writing Latin, should be maintained throughout the course. There should also be frequent written translations into idiomatic English.

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* See foot-note p. 46.

To prepare for the examination in Latin Composition, pupils should be trained, from an early stage of the preparatory course, to render into Latin not merely detached sentences, illustrative of constructions, but also passages of connected narrative or description, prepared by the teacher on the basis of the prose authors read.

6, 7. German.

6. *Elementary German.*

(*a*) The translation at sight of simple German prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into German of simple English sentences, or of easy, connected prose, to test the candidate's familiarity with elementary grammar.

The passages set for translation into English will be suited to the proficiency of candidates who have read not less than two hundred pages of easy German (including reading at sight in class).

Grammar should be studied concurrently with the reading as an indispensable means of ensuring thoroughness and accuracy in the understanding of the language. The requirement in elementary grammar includes the conjugation of the weak and the more usual strong verbs; the declension of articles, adjectives, pronouns, and such nouns as are readily classified; the commoner prepositions; the simpler uses of the modal auxiliaries: the elements of syntax, especially the rules governing the order of words.

Pronunciation should be carefully taught, and the pupils should have frequent opportunities to hear German spoken or read aloud. The writing of German from dictation is recommended as a useful exercise.

7. *Advanced German.*

(*a*) The translation at sight of ordinary German. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into German of a connected passage of English prose, to test the candidate's familiarity with grammar. Proficiency in grammar may also be tested by direct questions.

The passages set for translation into English will be suited to the proficiency of those who have read, in addition to the amount specified under Elementary German, not less than five hundred pages of classical and contemporary prose and verse. It is recommended that the reading be selected from such works as the following: Riehl, *Culturgeschichtliche Novellen;* Freytag, *Bilder aus der deutschen Vergangenheit*, *Die Journalisten;* Kohlrausch, *Das Jahr 1813;* Schiller, *Der dreissigjährige Krieg*, *Wilhelm Tell*, *Maria Stuart*, *Die Jungfrau von*

Orleans; Goethe, *Hermann und Dorothea, Egmont, Iphigenie;* Lessing, *Minna von Barnhelm.* About one half of the amount read should be Nineteenth Century prose.

In the translation into German candidates will be expected to show a thorough knowledge of accidence, the elements of word-formation, the principal uses of prepositions and conjunctions, and the essentials of syntax, especially the use of the modal auxiliaries, and of the subjunctive and infinitive modes.

It is recommended that the candidate be trained to follow a recitation conducted in German and to answer in that language questions asked by the instructor.

8, 9. French.

8. *Elementary French.*

(*a*) The translation at sight of ordinary Nineteenth Century prose. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into French of simple English sentences or of easy, connected prose, to test the candidate's familarity with elementary grammar. Proficiency in Grammar may also be tested by direct questions, based on the passages set for translation under (*a*).

The passages set for translation into English will be suited to the proficiency of candidates who have read not less than four hundred pages (including reading at sight in class) from the works of at least three different authors. It is desirable that a portion of the reading should be from works other than works of fiction.

Grammar should be studied concurrently with the reading as an indispensable means of ensuring thoroughness and accuracy in the understanding of the language. The requirement in elementary grammar includes the conjugations of regular verbs, of the more frequent irregular verbs, such as *aller, envoyer, tenir, pouvoir, voir, vouloir, dire, savoir, faire,* and those belonging to the classes represented by *ouvrir, dormir, connaître, conduire,* and *craindre;* the forms and positions of personal pronouns and of possessive, demonstrative, and interrogative adjectives; the inflection of nouns and adjectives for gender and number, except rare cases; the use of articles, and the partitive constructions.

Pronunciation should be carefully taught, and pupils should have frequent opportunities to hear French spoken or read aloud. The writing of French from dictation is recommended as a useful exercise.

9. *Advanced French.*

(*a*) The translation at sight of standard French. (The passages set for translation must be rendered into simple and idiomatic English.)

(*b*) The translation into French of a connected passage of English prose, to test the candidate's familiarity with grammar. Proficiency in grammar may also be tested by direct questions.

The passages set for translation into English will be suited to the proficiency of candidates who have read, in addition to the amount specified under Elementary French, not less than six hundred pages of prose and verse from the writings of at least four standard authors. A considerable part of the amount read should be carefully translated into idiomatic English.

Candidates will be expected to show a thorough knowledge of accidence and familiarity with the essentials of French syntax, especially the uses of tenses, modes, prepositions, and conjunctions.

It is recommended that the candidate be trained to follow a recitation conducted in French and to answer in that language questions asked by the instructor.

10, 11. History (including Historical Geography).

10. *Elementary History.*

Either of the two following groups, each including two fields of historical study : —

1. *Greek and Roman History.* —(*a*) Greek History to the death of Alexander, with due reference to Greek life, literature, and art. (*b*) Roman History to the accession of Commodus, with due reference to literature and government.

2. *English and American History.* — (*a*) English History, with due reference to social and political development. (*b*) American History, with the elements of Civil Government.

For preparation in each of the two historical fields presented, a course of study equivalent to at least three lessons a week for one year will be necessary.

The candidate will be expected to show on examination such general knowledge of each field as may be acquired from the study of an accurate text-book of not less than 300 pages, supplemented by suitable parallel readings amounting to not less than 500 pages. The examination will call for comparison of historical characters, periods, and events, and in general for the exercise of judgment as well as of memory. Geographical knowledge will be tested by means of an outline map.

In the judgment of the Department of History it is desirable that Greek and Roman History be offered as a part of the preparation of every candidate.

11. *Advanced History.*

Any one of the four courses of study which follow : —

1. Greek History to the destruction of Corinth and Roman History to the death of Constantine (open to those candidates only who have offered English and American History as an elementary study).

2. English History and American History (open to those candidates only who have offered Greek and Roman History as an elementary study).

3. European History from the German conquests to the beginning of the Seventeenth Century.

4. A year's study of any one of the four historical fields defined under Elementary History and not already offered by the candidate, together with a year's detailed study of a limited period* within that field, selected with the approval of the Department of History.

The examination in the second part of 4 will be specially adapted to the particular period selected and will be held in Cambridge only.

In every case the candidate will be expected to show on examination such an acquaintance with the whole field as may be gained from the study of good text-books, together with substantial parallel readings, and, further, such a detailed knowledge of some part of the field as may be gained from suitable topical study. A higher standard of acquirement and of power to combine results will be expected than in the elementary requirement.

As further evidence of the candidate's proficiency satisfactory written work, done at school and certified by the teacher, must be submitted at the time of the examination. It must be presented in the form of a note-book (or bound collection of notes), containing not less than 50 written pages on each historical field offered, and must show practice in some of the following exercises : —

(*a*) Notes and digests of the pupil's reading outside of the text-books.

(*b*) Brief written tests requiring the application to new questions of knowledge previously acquired.

(*c*) Parallels between historical characters of periods.

(*d*) Short studies of topics limited in scope, prepared outside of the class-room and illustrated by some reference to contemporary material.

(*e*) Historical maps or charts showing explorations, migrations, conquests, territorial changes, or social conditions.

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* For example, the Spartan and Theban supremacies, the period of the Punic wars, the Stuart Period, the transition from the American colonial to the federal system.

12-15. Mathematics.

A thorough practical acquaintance with ordinary Arithmetic is assumed as underlying all preparation in Mathematics. Knowledge of the fundamental principles of Arithmetic and careful training in accurate computation with whole numbers and with vulgar and decimal fractions form an essential part of early school work. But the pupil's time should not be wasted in the solution by arithmetic of puzzling problems which properly belong to algebra, or in complicated and useless reductions, or in the details of commercial arithmetic. It is desirable that some familiarity with algebraic expressions and symbols, including the methods of solving simple equations, be acquired in connection with the course in Arithmetic.

Elementary Mathematics.

12. *Elementary Algebra.* —Algebra, through Quadratic Equation. (As heretofore.)

The requirement in Algebra includes the following subjects: factors, common divisors and multiples, fractions, ratios and proportions; negative quantities and the interpretation of negative results; the doctrine of exponents; radicals and equations involving radicals; the binomial theorem for positive integral powers of the binomial, and the extraction of roots; putting questions into equations and the reduction of equations; the ordinary methods of elimination and the solution of both numerical and literal equations of the first and second degrees with one or more unknown quantities and of problems leading to such equations.

The student should cover carefully the whole ground here specified, and should acquire a thorough understanding not only of the practice, but of the reasons involved in the elementary algebraic rules; for example, in the rules of multiplication, of signs, and of exponents, in the rules for fractions, and in those relating to the reduction and solution of equations. He should train himself to practical skill by the solution of a large number of examples, and should learn to do his work with reasonable quickness, as well as with confidence, accuracy, and clearness. The solution of fairly complicated literal quadratics, the various methods of elimination for equations of the first two degrees, the putting of problems in a neat manner into equations, and the working of the various algebraic operations both for integral and fractional expressions may be mentioned as important subjects of attention. The student should be taught to arrange his work in a clear, orderly, and compact fashion.

The time supposed to be devoted to the systematic study of the requirement in Algebra is the equivalent of a course of three lessons a week through two school years.

13. *Geometry.* — Plane and Solid Geometry, including problems in mensuration of plane and solid figures, and original propositions in Plane Geometry.

Geometric education should begin in the kindergarten or primary school, where the child should acquire familiarity through the senses with simple geometric forms, by inspecting, drawing, modelling, and measuring them, and noting their more obvious relations. This study should be followed, in the grammar school, by systematic instruction in Concrete (or Observational) Geometry, of which geometric drawing should form a part. Such instruction should include the main facts of Plane and Solid Geometry, treated as matters of observation, and not as exercises in logical deduction, without however necessarily excluding the beginnings of deductive proof as soon as the pupil is ready for them. Concrete Geometry is believed to have important educational value, and to prepare an excellent foundation for the later study of Formal Geometry. It belongs, however, to the earlier stages of school work, and should not be postponed until the time that belongs to direct preparation for college or the scientific school.

In teaching Formal Geometry, stress should be laid from the outset on accuracy of statement and elegance of form, as well as on clear and strict reasoning. As soon as the pupil has begun to acquire the art of rigorous demonstration, his work should cease to be merely receptive, he should be trained to devise constructions and demonstrations for himself, and this training should be carried through the whole of the work in Plane Geometry. Teachers are advised, in their selection of a text-book, to choose one having a clear tendency to call out the pupil's own powers of thought, prevent the formation of mechanical habits of study, and encourage the concentration of mind which it is a part of the discipline of mathematical study to foster. The subject of Geometry, not a particular treatise, is what the pupil should be set to learn; and its simpler methods and conceptions should be made a part of his habitual and instinctive thought. Lastly, the pupil should be stimulated to good work by interest in the study felt and exhibited by the teacher.

The requirement in Geometry embraces the following topics: the general properties of plane rectilinear figures; the circle and the measure of angles; similar polygons; areas; regular polygons, and the measure of the circle; the relations of planes and lines in space; the properties and measure of prisms, pyramids, cylinders, and cones; the sphere and the spherical triangle. The propositions required under these several heads are those only which are contained in the older treatises, and which are recognized as constituting the Elements of Geometry. The examination does not include the additions introduced into some recent text-books, although most of those additions are in themselves valuable for the student who has time and taste for extra study in this field. A

syllabus of the required propositions has been prepared. [*This syllabus may be obtained, price 10 cents, at the Publication Office of Harvard University, 2 University Hall, Cambridge.*]

The examination in Geometry also includes original propositions in Plane Geometry, based on the propositions named in the syllabus, and problems in mensuration in both Plane and Solid Geometry; but excellence in bookwork and in exercises immediately illustrating bookwork will be allowed to offset in part any lack of skill in original work.

The time which it is recommended to assign to the systematic study of the requirement in Formal Geometry is the equivalent of a course of five lessons a week for one school year; but it is believed to be advisable to extend this allowance of time over two years.

13a. *Plane Geometry.*

13b. *Solid Geometry.*

Advanced Mathematics.

14. *Logarithms and Trigonometry.* — The theory of logarithms and the use of logarithmic tables. — Plane trigonometry. — The solution of the right spherical triangle. — Applications to simple problems.

No technical knowledge of the subjects of surveying and navigation, such, for instance, as the methods of parallel or middle latitude sailing, will be required, but such terms as latitude, longitude, angle of elevation or depression, bearing, etc., should be understood. At the examination, candidates are furnished with four-place tables belonging to the University, and are not allowed to use their own tables. The tables provided are distributed before the hour of examination, so that candidates may have at least an hour for becoming acquainted with their arrangement and use. Teachers who wish a still earlier opportunity of seeing these tables should write to the Corresponding Secretary of the University.

15. *Advanced Algebra.* (Substantially as heretofore.)

The requirement in Advanced Algebra includes the following subjects:

(*a*) Simultaneous quadratics and equations solved like quadratics; properties of quadratic equations; addition, subtraction, multiplication and division of complex quantities; inequalities; variations; arithmetical and geometrical progressions; mathematical induction; simple problems in choice and chance; continued fractions; scales of notation.

(*b*) Determinants, not including the multiplication theorem; simple applications of determinants to linear equations; the solution of numerical equations of higher degree, and so much of the theory of equations (not including multiple roots or Sturm's theorem) as is necessary for this purpose.

The topics included under (*a*) may be treated briefly. About half the time devoted to the requirements should be spent on the topics included under (*b*).

16-22. Physical Science.

Elementary Physical Science.

16. *Elementary Physics.* — A course of study dealing with the leading elementary facts and principles of physics, with quantitative laboratory work by the pupil.

The instruction given in this course should include qualitative lecture-room experiments, and should direct especial attention to the illustrations and applications of physical laws to be found in every-day life. The candidate is required to pass a written examination, the main object of which will be to determine how much he has profited by such instruction. This examination may include numerical problems. It will contain more questions than any one candidate is expected to answer, in order to make allowance for a considerable diversity of instruction in different schools.

The pupil's laboratory work should give practice in the observation and explanation of physical phenomena, some familiarity with methods of measurement, and some training of the hand and the eye in the direction of precision and skill. It should also be regarded as a means of fixing in the mind of the pupil a considerable variety of facts and principles. The candidate is required to pass a laboratory examination, the main object of which will be to determine how much he has profited by such a laboratory course.

The candidate must name as the basis for his laboratory examination at least thirty-five exercises selected from a list of about sixty, described in a publication issued by the University under the title, "Descriptive List of Elementary Exercises in Physics." In this list the divisions are mechanics (including hydrostatics), light, heat, sound, and electricity (with magnetism). At least ten of the exercises selected must be in mechanics. Any one of the four other divisions may be omitted altogether, but each of the three remaining divisions must be represented by at least three exercises.

The candidate is required to present a note-book in which he has recorded the steps and the results of his laboratory exercises, and this note-book must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. It should contain an index of the exercises which it describes. These exercises need not be the same as those upon which the candidate presents himself for the laboratory examination, but should be equivalent to them in amount and grade of quantitative work.

The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of laboratory work through an extended course of experiments, and that his work has been of such a character as to raise a presumption in favor of his preparation for the examination. But much greater weight will be given to the laboratory

examination than to the note-book in determining the candidate's attainments in physics. Experience has shown that pupils can make the original record of their observations entirely presentable, so that copying will be unnecessary, and they should in general be required to do so.

This course, if taken in the last year of the candidate's preparation, is expected to occupy in laboratory work, recitations, and lectures, five of the ordinary school periods, about fifty minutes in length, per week for the whole year. With few exceptions exercises like those in the Descriptive List already mentioned can be performed in a single school period, but for satisfactory results it will often be necessary to repeat an exercise. Two periods per week for the year should be sufficient for the laboratory work proper. If the course is begun much earlier than the last year of the candidate's preparation, as it well may be, it will require more time.

17. *Chemistry.** — A course of at least sixty experiments, performed at school by the pupil and accompanied with systematic instruction in principles and their applications, in accordance with directions given in a pamphlet entitled "An Outline of Requirements in Chemistry," issued by the University for *the use of teachers only*.

The candidate is required to pass both a written and a laboratory examination. The written examination will test his acquaintance with the facts and principles of Chemistry. The laboratory examination will test both his skill in performing experiments and his grasp of the principles involved in them. The candidate is further required to present the original note-book in which he recorded the steps and results of the experiments which he performed at school, and this note-book must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. It should contain an index of the exercises which it describes.

The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of laboratory work through an extended course of experiments, and that his work has been of such a character as to raise a presumption in favor of his preparation for the examination. But much greater weight will be given to the laboratory examination than to the note-book in determining the candidate's attainments in Chemistry.

18. *Physiography.* — A course of study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Physiography," issued by the University.

For the form of examination see note under Astronomy, below.

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* Equivalent to Chemistry *B*. The course will be mainly an experimental course in theoretical chemistry, but there will be experiments covering all branches of pure chemistry.

19. *Anatomy, Physiology, and Hygiene.** — A course of study and laboratory work equivalent to that described in a pamphlet entitled "An Outline of Requirements in Anatomy, Physiology, and Hygiene," issued by the University.

The candidate will be required to pass both a written and a laboratory examination. The written examination will test the range and thoroughness of his knowledge of the elements of Anatomy, Physiology, and Hygiene. The laboratory examination will test (*a*) his ability to perform the experiments described in the Outline of Requirements, and (*b*) his knowledge of the first aids to be rendered to the injured.

At the time of the written examination the candidate must present the original note-book containing (with dates) the notes and drawings he has made in the course of his laboratory work, and bearing the endorsement of his teacher, certifying that the book is a true record of the pupil's own observations and experiments. An index of subjects should be appended.

Advanced Physical Science.

20. *Advanced Physics.*† (Substantially as heretofore.)

The University does not prescribe the experiments to be performed by those offering this subject for admission. The work should, however, be of advanced grade, almost wholly quantitative, and conducted with apparatus, not necessarily elaborate, yet capable, if carefully handled, of yielding results of such accuracy as to warrant the consideration of somewhat minute error. For example, the balance used in weighing should be so delicate as to justify corrections for the buoyancy of the air on the weights and on the body weighed, and, in the determination of specific gravity, for the temperature of the water. The results should be discussed with reference to their precision and to the number of significant figures. There should be about sixty experiments well distributed through the range of general physics. If the student has devoted a considerable amount of time in the elementary course to experiments in heat, that division of physics may be here omitted. The laboratory work can be performed properly only in periods of considerable length, two to four hours, for example.

Instruction by lectures or text-books and work in problems should be a part of the course.

The candidate will be required to pass both a laboratory and a written examination. He should so thoroughly understand the work which he has performed as not to be confused in the laboratory examination by unfamiliar forms of apparatus.

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* Equivalent to Hygiene 1 *hf*.

† Equivalent to, but not necessarily identical with, Physics *C*.

The laboratory note-book will receive careful attention at the time of the examination. It must contain a certificate from the teacher that it is a true record of the candidate's work.

21. *Meteorology.* — A course of observational study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Meteorology," issued by the University.

This course requires a knowledge of Elementary Physics. (For the form of examination see under Astronomy, below.)

22. *Astronomy.* — A course of observational study equivalent to that described in a pamphlet entitled "An Outline of Requirements in Astronomy," issued by the University.

This course requires a knowledge of Geometry.

In Physiography, Meteorology, and Astronomy, the candidate will be required to take both a written and a laboratory or practical examination. The written examination may test his understanding of observational methods appropriate to the subject, but will call chiefly for a knowledge of facts and principles. The laboratory or practical examination will test his skill in observation as well as his grasp of principles. This examination can be taken in Cambridge only; for those who are examined elsewhere in June, it will be postponed to September.

The laboratory examination in Physiography may include the description, explanation, and comparison of geographical features shown in photographs, maps, and models. The laboratory examination in Meteorology may include the use of instruments, the discussion of observations, and the construction and interpretation of weather maps and climatic charts. The practical examination in Astronomy may call for an ability to make simple naked-eye and instrumental observations, and to establish the simpler generalizations of astronomy by discussion of these observations.

The candidate in these subjects will be required to present, at the time of the laboratory or practical examination, the original note-book in which he recorded, with dates, the steps and results of the observations which he made at school. This book must bear the endorsement of his teacher, certifying that the notes are a true record of the pupil's work. An index of subjects should be appended. The note-book is required as proof that the candidate has formed the habit of keeping a full and intelligible record of his work through an extended course of observational study, and that his work has been of a satisfactory character; but greater weight will be given to the practical or laboratory examination than to the note-book in determining the candidate's attainments.

23, 24. Botany and Zoölogy.

23. *Botany.* — A course of study and laboratory work equivalent to that indicated in an "Outline of Requirements in Botany," issued by the University. The course should extend through at least half of a school year, with five lessons a week. The laboratory work is to be directed especially to the external anatomy and the activities of our common plants.

24. *Zoölogy.* — A course of study and laboratory work equivalent to that described in a pamphlet entitled "An Outline of Requirements in Zoölogy," issued by the University. The course should extend through at least half of a school year, with five lessons a week, and should include the laboratory study of at least ten types of animals, with special reference to their external anatomy and their activities. These types are to be selected in accordance with directions given in the pamphlet named.

In Botany and in Zoölogy the candidate will be required to pass both a written and a laboratory examination. The written examination will test the range and thoroughness of his knowledge of the subject. The laboratory examination will test his skill in observation and experimentation, and his ability to apply names properly to the parts of the organisms studied.

At the time of the written examination the candidate must present the original note-book containing (with dates) the notes and drawings he has made in the course of his laboratory work, and bearing the endorsement of his teacher, certifying that the book is a true record of the pupil's own observations and experiments. An index of subjects should be appended.

25–28. Shopwork.*

A course of instruction in the use of tools and in the ordinary processes employed in the working of wood or metal, equivalent to that described in a pamphlet entitled "An Outline of Requirements in Shopwork," issued by the University. The course may embrace one or more of the following divisions: —

25. *Wood-working;*
26. *Blacksmithing;*
27. *Chipping, Filing and Fitting;*
28. *Machine-tool Work.*

The candidate must be familiar with the names, construction, and operation of the tools commonly used in these processes, and will be expected to read ordinary mechanical drawings and to make freehand sketches of articles which are to be produced in the workshop.

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* Each of the courses numbered 25, 26, 27, 28, 29 and 30 is to be equivalent to a half-course in the Lawrence Scientific School.

The candidate is required to pass both a written and a laboratory examination. The written examination will test his knowledge of tools and mechanical processes, and of the properties of materials of common use in construction. He will be expected to show familiarity with approved methods for simple work in the branch in which he presents himself for examination, and to write an intelligible description of those methods, illustrated by such sketches as may be necessary to make them clear. The laboratory examination will test the candidate's skill in the use of tools. He will receive the materials and specifications for a piece of work, and will be expected to select his tools, preparing them for use if necessary, and to demonstrate satisfactorily his knowledge and skill.

Every candidate is further required to present the original note-book in which he entered the descriptions and sketches of the work he performed at school; and with this he may present, as evidence of his skill in the workshop, the models made by him at school. Both the note-book and the models must be accompanied by the endorsement of his teacher, certifying that the book is a true record, and that the models are specimens, of the pupil's own work.

29, 30. Drawing.*

A course of drawing, in either or both of the following branches, equivalent to that described in an "Outline of Requirements in Drawing," issued by the University: —

29. *Freehand Drawing.* — The representation of simple objects, in outline and with shading.

Accuracy of delineation, correctness of proportion, and good quality of line are desired rather than any attempt at elaboration. The aim should be to express as much as possible with the fewest lines. The examination will consist of the drawing, first, of a group of geometrical solids, and, second, of either a simple piece of machinery or a simple piece of architectural ornament (such as a Greek anthemion), as the candidate may elect.

30. *Projections.* — The projection in plan and elevation of geometrical figures and of simple parts of architectural subjects or machinery.

The examination will test the candidate's knowledge of principles and methods. Every candidate is expected to bring to the examination the ordinary drawing instruments and lead-pencils; drawing-board and paper will be supplied. Every candidate is further required to present a set of plates or drawings prepared by him at school, sufficient to demonstrate his understanding of the subject and his familiarity with instruments, including the use of the right-line pen; and these drawings must be accompanied by the certificate of his teacher stating that they are the pupil's own work.

* Each of the courses numbered 25, 26, 27, 28, 29 and 30 is to be equivalent to a half-course in the Lawrence Scientific School.

II. *OLD DEFINITIONS.

(*Valid in 1900 and 1901, but not thereafter.*)

The examinations for admission embrace two classes of studies, *Elementary* and *Advanced*.

The Elementary Studies are not treated as equivalent. The Advanced Studies are regarded as occupying equal amounts of time in school, and are of equal importance in the examinations.

Elementary Studies.

1. *English*.† — The examination will occupy two hours and will consist of two parts, which, however, cannot be taken separately : —

I. The candidate will be required to write a paragraph or two on each of several topics chosen by him from a considerable number — perhaps ten or fifteen — set before him on the examination paper. In 1900 the topics will be drawn from the following works : —

Dryden's Palamon and Arcite; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Scott's Ivanhoe; De Quincey's Flight of a Tartar Tribe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal.

The candidate is expected to read intelligently *all* the books prescribed. He should read them as he reads other books; he is expected not to know them minutely, but to have freshly in mind their most important parts. In every case the examiner will regard knowledge of the book as less important than ability to write English.

As additional evidence of preparation, the candidate may present an exercise book, properly certified by his instructor, containing compositions or other written work.

The works prescribed for this part of the examination in 1901 and 1902 are as follows : —

Shakspere's Merchant of Venice; Pope's Iliad, Books I, VI, XXII, and XXIV; The Sir Roger de Coverley Papers in the Spectator; Goldsmith's Vicar of Wakefield; Coleridge's Ancient Mariner; Scott's Ivanhoe; Cooper's Last of the Mohicans; Tennyson's Princess; Lowell's Vision of Sir Launfal; George Eliot's Silas Marner.

II. A certain number of books are prescribed for careful study. This part of the examination will be upon subject-matter, literary form, and logical structure, and will also test the candidate's ability to express his knowledge with clearness and accuracy.

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* For new definitions, see page 45.

† See, also, pp. 45, 74.

The books prescribed for this part of the examination are : —

In 1900 : Shakspere's Macbeth ; Milton's Paradise Lost, Books I and II ; Burke's Speech on Conciliation with America ; Macaulay's Essays on Milton and Addison.

In 1901 and in 1902 : Shakspere's Macbeth ; Milton's Lycidas, Comus, L'Allegro and Il Penseroso ; Burke's Speech on Conciliation with America ; Macaulay's Essays on Milton and Addison.

No candidate will be accepted in English whose work is seriously defective in point of spelling, punctuation, grammar, or division into paragraphs.

In connection with the reading and study of the prescribed books, parallel or subsidary reading should be encouraged, and a considerable amount of English poetry should be committed to memory. The essentials of English grammar should not be neglected in preparatory study.

The English written by a candidate in any of his examination-books may be regarded as part of his examination in English, in case the evidence afforded by the examination-book in English is insufficient.

A candidate who has passed the examination in Elementary English with a grade of *A* or *B* may take a second examination, which, if passed with a grade of *A* or *B*, shall exempt him from the prescription of English *A* (prescribed Freshman English).

At this examination, which will be held in September only, a candidate will write one or more compositions on topics to be selected by him from a list comprising subjects in English Literature, the Classics, French and German authors, History, and Science. The examination will occupy two hours.

The attention of candidates who have passed in English at the Preliminary Examination is called to another method of anticipating English *A* (see Optional Examinations, p. 73).

2. *Greek.* — The translation at sight of simple Attic prose (with questions on the usual forms and ordinary constructions of the language).

3. *Latin.* — The translation at sight of simple prose (with questions as in Greek).

The passages set for translation must be rendered into simple and idiomatic English. Teachers are requested to insist on the use of good English as an essential part of the candidate's training in translation.

In Latin the following pronunciation is recommended : — *ā* as in *father*, *ă* the same sound but shorter ; *ē* like *é* in *fête*, *ĕ* as in *set* ; *ī* as in *machine*, *ĭ* as in *sit* ; *ō* as in *hole*, *ŏ* as in *nor* ; *ū* as in *rude*, *ŭ* as in *put* ; *j* like *y* in *year*, *c* and *g* like Greek *κ* and *γ*.

Instructors are requested to teach their pupils in pronouncing Greek to use the *Greek accents*, and to give (for example) *a* the sound of *a* in *father*, *η* that of *a* in *fate*, *ι* that of *i* in *machine*, etc.

It is further recommended that pupils be accustomed, from the beginning of the preparatory course in Greek and Latin, to translate into those languages, both orally and in writing, passages prepared by the teacher on the basis of the prose authors read.

4. *German.* — The translation at sight of simple prose.

5. *French.* — The translation at sight of ordinary prose.

The passages set for translation in 4 and 5 will be similar to those set at the final examinations in German *A* and French *A* respectively, — College courses, each having three hours of instruction a week through the year. The passages set for translation must be rendered into simple and idiomatic English. A knowledge of the language itself, rather than of the grammar, is expected; but proficiency in elementary grammar, or facility in writing the language, will be accepted as an offset for some deficiency in translation. It is recommended that from the outset attention be given to pronunciation. Wherever possible, care should be taken, during the whole course of preparation, to accustom the pupil to hear and understand spoken German and French.

6. *History (including Historical Geography).* — Either (1) History of Greece and Rome; or (2) History of the United States and of England.

The following works will serve to indicate the amount of knowledge demanded in History: Oman's History of Greece; Allen's History of the Roman People (the whole), *or* Leighton's History of Rome (to the death of Commodus); Higginson's Young Folks' History of the United States (to the end of Chapter XXI), and Johnston's History of the United States for Schools (beginning at §269); Guest and Underwood's Handbook of English History (to the year 1793), or Gardiner's Student's History of England (through Part IX).

The following selections are recommended for additional reading and will be made the basis of optional questions in the examinations: *—

For Greek History: Curtius's History of Greece, Book I, Ch. I, Book II, Ch. IV, and Book III, Ch. III.

For Roman History: Beesly's The Gracchi, Marius, and Sulla; Tighe's Development of the Roman Constitution.

For American History: Lodge's English Colonies, Chapters II and XXII; Morse's John Quincy Adams, Chapters II and III; Josiah Quincy's Figures of the Past.

For English History: Macaulay's History of England, Chapters I and III.

7. *Mathematics.* — (*a*) Algebra, through Quadratic Equations. (*b*) Plane Geometry.

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* Candidates who take the questions on the Selections will be allowed to omit some of the questions on the corresponding Manual.

The requirement in Algebra embraces the following subjects: factors, common divisors and multiples, fractions, ratios and proportions; negative quantities and the interpretation of negative results; the doctrine of exponents; radicals and equations involving radicals; the binomial theorem for positive integral exponents and the extraction of roots; putting questions into equations and the reduction of equations; the ordinary methods of elimination and the solution of both numerical and literal equations of the first and second degrees with one or more unknown quantities and of problems leading to such equations.

8. *Physical Science.* — Either (1) Astronomy (Young's Lessons in Astronomy, Ginn & Co., omitting the appendix) and Physics (Avery's Elements of Natural Philosophy,* or Gage's Elements of Physics); or (2) a course of experiments not less than forty in number performed at school by the pupil. These must be selected from a list issued by the University under the title *Descriptive List of Elementary Exercises in Physics*,† or must be approved by the Department of Physics as the equivalent of those contained in this list.

The Faculty requests all teachers who can command the necessary apparatus to present their pupils in (2) rather than in (1). (For the character of the examination in (2) see the note under Advanced Studies 8 and 9.)

Advanced Studies.

Each of the Advanced Studies is taught in Harvard College in an elective course (or two half-courses) occupying three hours a week for a year; and the standard of the entrance examinations is the same as that of the corresponding College courses. The following are the College courses to which the Advanced Studies of the admission examination correspond: — Advanced Greek corresponds to Greek *A*, Advanced Latin to Latin *A*, Greek Composition to Greek *F*, Latin Composition to Latin *F*, Advanced German to German *B*, *C*, 1*a*, or 1*b*, Advanced French to French 1*c* or 1*a*, Logarithms and Plane Trigonometry to Mathematics *A*, Solid Geometry to Mathematics *E*, Analytic Geometry to Mathematics *B*, Advanced Algebra to Mathematics *D*, Advanced Physics to Physics *C*, and Chemistry to Chemistry *B*. Elementary German, French, and Physical Science (2) correspond to German *A*, French *A*, and Physics B, respectively.

The letters (*a*) and (*b*), in the studies numbered 3, 6, and 7, designate sub-divisions, which correspond to College half-courses. These may be combined at the option of the candidate.

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* The following portions of the 1885 edition may be omitted: — sections I and II of chap. I (excepting arts. 23–30), arts. 254–267, 346–349, 371, 411–415, 445–455, 464–467, 470–476, 707–714, 729–745, and the whole Appendix.

† This list can be procured (price, forty cents) by application to the Harvard Coöperative Society or to C. W. Sever & Co., Booksellers, Cambridge.

1. *Greek.* — The translation at sight of average passages from Homer *or* the translation at sight of less difficult passages from both Homer and Herodotus (with questions on the usual forms and ordinary constructions of the language and on prosody).

2. *Latin.* — The translation at sight of average passages from Cicero and Virgil (with questions as in Greek).

3. *Greek and Latin Composition.* — (*a*) The translation into Attic prose of a passage of connected narrative. (*b*) The translation into Latin of a similar passage.

In preparing for this subject, it is strongly urged that from an early stage pupils be accustomed to translate into Greek and Latin not merely detached sentences illustrative of constructions, but also passages of connected narrative prepared by the teacher on the basis of the prose authors read. The passages set at the examination will be of this character. Examples of the kind of exercise recommended may be found in the following books: The Beginner's Greek Composition, by Collar and Daniell (Boston: Ginn & Co.); Allinson's Greek Prose Composition (Boston: Allyn & Bacon); Woodruff's Exercises in Greek Prose Composition (Boston: Leach, Shewell, & Sanborn); Collar's Practical Latin Composition (Boston: Ginn & Co.); Daniell's Exercises in Latin Composition (Boston: Leach, Shewell, & Sanborn).

4. *German.* — The translation at sight of modern German prose. — Grammar. — Composition based upon the following books: Riehl (Der Fluch der Schönheit). — Freytag (Aus dem Staat Friedrichs des Grossen). — Heine (Die Harzreise). — Goethe (the first three books of Dichtung und Wahrheit). — Lessing (Minna von Barhelm). — Schiller (Wilhelm Tell and Das Lied von der Glocke). — Thirty pages of lyrics and ballads.

5. *French.* — The translation at sight of standard French prose. — Grammar. — Composition based upon the following books: Daudet (La Dernière Classe. — Le Siège de Berlin). — Mérimée (Colomba). — Sandeau (Mlle. de la Seiglière, the play). — Corneille, Racine, Molière (one play by each author).

In advanced German and French, translation at sight will form an important part of the examination. Candidates will be expected to be familiar with the subject-matter as well as the language of the prescribed books. Some of the books may be changed from time to time, but with not less than two years' notice. The passages set for translation into German or French will be suited to the proficiency of those who have begun to study the language in College and have had instruction in it three hours a week for two years.

6. *Mathematics.* — (*a*) Logarithms*; Plane Trigonometry, with its applications to Surveying and Navigation. (*b*) Solid Geometry.

7. *Mathematics.* — (*a*) The Elements of Analytic Geometry. (*b*) Advanced Algebra.

The following books will serve to indicate the nature and amount of the requirements in Logarithms and Trigonometry, Solid Geometry, Analytic Geometry, and Advanced Algebra: —

Logarithms and Trigonometry. Wheeler's Logarithms (Cambridge: Sever) or the unbracketed portions of Peirce's Elements of Logarithms (Boston: Ginn & Co.). Wheeler's Plane Trigonometry (same publishers). Problems in Plane Trigonometry (Cambridge: Sever). Peirce's Mathematical Tables, chiefly to four places (Boston: Ginn & Co.).*

Solid Geometry. Chauvenet's Geometry, Revised and Abridged (Philadelphia: J. B. Lippincott & Co.), Books VI, VII, VIII, and IX.

Analytic Geometry. Briggs's Analytic Geometry (New York: Wiley & Co.).

Advanced Algebra. Wentworth's College Algebra (Boston: Ginn & Co.), to article 496, omitting in Chapter XV to §207, Chapters XVII, XIX, XX, in Chapter XXI, §§310–314, in Chapter XXII, §§321–331, Chapters XXV, XXVI, XXVII, in Chapter XXIX, §§452–463, also §476.

8. *Physical Science.* — Physics. A course of at least sixty experiments in addition to those of the Elementary Physics (2) selected from the same or similar manuals, and covering the same subjects, but demanding more skill and more knowledge of physical theories and laws.

9. *Physical Science.* — Chemistry. A course of at least sixty experiments in General Chemistry actually performed at school by the pupil.

Examinations in Physical Science.

In Elementary Physics (2), in Advanced Physics, and in Chemistry, the candidate will be required to pass both a written and a laboratory examination. The written examination will test his knowledge of experiments and experimenting as well as his knowledge of principles and results. The laboratory examination will test his skill in experimenting. The candidate will be required to hand in the original note-book in which he recorded the steps and the results of the experiments which he performed at school; and this note-book must bear the indorsements of his teacher, certifying that the notes are a true record of the pupil's work. The note-book in Physics should contain an index of the exercises which it describes.

* Candidates are required to use at the examinations the four-place Tables provided by the University. Teachers unfamiliar with these Tables, who wish to see them before the examinations, should write to the Corresponding Secretary.

A candidate who offers Elementary or Advanced Physics or Chemistry must hand in his laboratory note-book at *the hour of the laboratory examination.* Laboratory note-books will be deposited, after examination, in the College office, where they will be kept for a reasonable time, subject to the order of the owners.

A candidate examined in June at any place where a laboratory examination is not provided will be required to take such an examination in Cambridge in the autumn, in Sever Hall on Wednesday, September 26, at 1.30 P.M.; but if he passes the written examination in June and presents a satisfactory note-book, the subject will be temporarily counted in his favor in determining the question of his admission to College. Similarly a Preliminary Candidate is allowed to postpone his laboratory examination until September of the year in which he enters College.

Most pupils need lectures or other oral explanations in addition to the descriptions given in the laboratory manuals. When it is impossible to provide lectures, two text-books treating the subject from different points of view are advantageous.

Examination Papers.

A set of recent examination papers will be sent free on application to the Secretary, No. 16, University Hall. Separate papers may be had in quantities of not less than *six* copies of any *one paper* (not one each of six different papers) at ten cents a dozen on application to the Publication Agent of the University, No. 2, University Hall.

TIMES AND PLACES OF EXAMINATION.

Two regular examinations for admission to the Freshman Class of Harvard College and to the First-Year Class of the Lawrence Scientific School are held each year, — the June examination, at the beginning of the summer vacation, and the September examination, before the beginning of the academic year in the autumn.

June Examinations.

In 1900, the *June examinations* were held on *Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday, June 25, 26, 27, 28, 29, and 30.*

The examinations were held in the following places: —

In *Cambridge*, in Sever Hall.
In *Quincy*, in the rooms of the Adams Academy.
In *Andover*, in the rooms of the Phillips Academy.
In *Milton*, in the rooms of Milton Academy.
In *Groton*, in the rooms of Groton School.
In *Southborough*, in the rooms of St. Mark's School.
In *Worcester*, in the rooms of the English High School.
In *Springfield*, in the rooms of the Springfield High School.
In *Fall River*, in the Durfee High School Building.
In *South Byfield*, in the rooms of the Dummer Academy.
In *Exeter, N.H.*, in the rooms of Phillips Exeter Academy.
In *Concord, N.H.*, in the rooms of St. Paul's School.
In *Portland, Me.*, in the rooms of the Portland High School.
In *Pomfret Centre, Conn.*, in the rooms of the Pomfret School.
In *Washington, Conn.*, in the rooms of the Gunnery.
In *New York, N.Y.*, in the lecture-room of the Young Men's Christian Association, Twenty-third Street, corner of Fourth Avenue.
In *Garden City, N.Y.*, in the rooms of St. Paul's Cathedral School.
In *Albany, N.Y.*, in the rooms of the Young Men's Christian Association.
In *Buffalo, N.Y.*, in the High School building, corner of Court and Franklin Streets.
In *Lawrenceville, N.J.*, in the rooms of the Lawrenceville School.
In *Philadelphia, Pa.*, in the rooms of the Young Men's Christian Association building, corner of Fifteenth and Chestnut Streets.
In *Pottstown, Pa.*, in the rooms of the Hill School.
In *Washington, D.C.*, in the rooms of the Columbian University, corner Fifteenth and H Streets.
In *Louisville, Ky.*, in the rooms of the Young Men's Christian Association, corner of Fourth Avenue and Broadway.

In *Milwaukee, Wis.*, in the rooms of the Young Men's Christian Association, 147 Fourth Street.
In *Cleveland, O.*, in the Central High School building.
In *Cincinnati, O.*, in the rooms of the Young Men's Christian Assotion.
In *Youngstown, O.*, in the rooms of the Rayen School.
In *Chicago, Ill.*, in the rooms of the West Division High School.
In *St. Paul, Minn.*, in the rooms of the Young Men's Christian Association, West Fifth St., next to the Post Office.
In *St. Louis, Mo.*, in the rooms of the High School.
In *Kansas City, Mo.*, in Association Building, 810 Wyandotte St.
In *Denver, Col.*, in the rooms of the Denver High School (District No. 1), corner of Nineteenth and Stout Streets.
In *San Francisco, Cal.*, in the rooms of the Mechanics' Institute, 31 Post Street.
In *Belmont, Cal.*, in the rooms of the Belmont School.
In *Portland, Oregon*, in the lecture-room of the Portland Library.
In *Bonn, Germany*, at the Hotel Kley.
In *Honolulu*, Hawaii.

The University will ordinarily conduct the admission examinations in June in any school or city where a sufficient number of candidates shall present themselves for examination; provided that the school or city be not within easy reach of one of the regular places of examination. Applications for examinations in June, in schools or cities not named above, should be made to the Corresponding Secretary of Harvard University as early as *April 1*.

Required Notice and Fees.

For the notice and the fees required of candidates examined in any place other than Cambridge, see p. 39.

September Examinations.

The *September examinations* will be held *in Cambridge only*, on *Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday, September 17, 18, 19, 20, 21, and 22.*

Order of Examinations (June and September).

All candidates must present themselves punctually at 8 A.M. on the day of their first written examination, and at 8 A.M. on each succeeding day on which they offer a subject in which a laboratory examination is prescribed. Candidates offering Elementary Physics must present themselves at 8 A.M. Thursday. .

Monday, June 25 and September 17.

8 A.M. Candidates offering any of the subjects of this day meet the officer in charge of the examinations.

9–10. Wood-working.
10–11. Blacksmithing.
11–12. Anatomy, Physiology, and Hygiene.
2–3. Machine-tool Work.
3–4. Chipping, Filing, and Fitting.

Tuesday, June 26 and September 18.

8 A.M. Candidates offering any of the subjects of this day meet the officer in charge of the examinations.

9–11. Advanced German.
11¼–12¼. Chemistry.
12¼–1¼. Advanced Algebra.
2–3. Solid Geometry.
3–4. Advanced Physics.
4–5. Log. and Trig.
5–6. Analytic Geometry.

Wednesday, June 27 and September 19.

8 A.M. Candidates offering any of the subjects of this day meet the officer in charge of the examinations.

9–10. Physiography.
10–11. Meteorology.
11–12. Astronomy.
12–1. Botany.
2–3. Zoölogy.

Thursday, June 28 and September 20.

8–9. Candidates offering any of the subjects of the last three days meet the officer in charge of the examinations.

9–11. Elementary Latin.
11¼–1¼. Elementary Greek.
2–3. Greek Composition.
3–4. Latin Composition.
4–6. Advanced Latin.

Friday, June 29 and September 21.

8–9. Elementary Physics.
9¼–11¼. Geometry.
9¼–10¾. Plane Geometry.
11½–1. Elementary Algebra.
1¾–3¾. English.
4–6. Advanced Greek.

Saturday, June 30 and September 22.

8–9½. Elementary French.
9¾–11¼. Elementary German.
11½–1. Elementary History.
1¾–3¾. Advanced French.
4–6. Advanced History.

Examinations in Drawing.

Examinations in Freehand Drawing and in Projections will be held only in Cambridge. Candidates offering these subjects must meet the officer in charge of the examinations at 8 A.M. Monday of the examination periods. Appointments will then be made for the examinations.

Laboratory Examinations.

Appointments for laboratory examinations will be made when the candidates meet the officer in charge of the examinations.

In June, classes from schools near Cambridge may, by special arrangement, take the laboratory examinations in Physics and Chemistry on earlier days.

Candidates who have received a provisional pass in laboratory subjects must meet in Sever Hall on Wednesday, September 26, at 1.30 P.M. to make appointments for laboratory examinations. These examinations, however, may be taken during the entrance examination period.

Examinations in English *A*, German *A*, and French *A*.

In 1900, the examination in English *A* will be held in accordance with the programme given below. This examination, formerly held in Cambridge only, is now held, *in June*, at all the places named on pages 69, 70.

Wednesday, June 27, and September 19.

3–6 P.M. English *A*.

The examinations in German *A* and French *A* correspond to the admission examinations in Elementary German and French (see pp. 49, 50), and are held on *Saturday, June 30*, and *Saturday, September 22*.

Examinations in Elective Studies.

Examinations in prescribed and elective studies that are not equivalent to advanced admission studies are held only in the first fortnight of the academic year and only at Cambridge. Written notice of intention to take these examinations must be in the hands of the Corresponding Secretary not later than *September 10*. The examinations in such elective studies as correspond to advanced admission studies (see p. 71) are identical with the examinations in the latter, and must be taken at the same times and places.

OPTIONAL EXAMINATIONS FOR ADVANCED STANDING.

Anticipation of Prescribed Studies.

In addition to the examinations required for admission to the Scientific School, optional examinations are provided for such candidates as have extended their studies beyond the requirements.

I. A candidate may present himself for examination in any of the Advanced Studies not offered by him for admission, and thus qualify himself to pursue more advanced courses in those subjects in the School.

II. A candidate may present himself for additional examinations in courses which are of such a character that they may be properly anticipated by examination, (see p. 72).

The examinations in prescribed first-year English and in courses which correspond to Advanced Admission Studies may be taken either in June or in September, or partly in June and partly in September.

The examinations in *other studies* are held *in the autumn only*. Written notice of intention to take these examinations must be in the hands of the Corresponding Secretary not later than *September 10*.

A student who has anticipated any of the studies of the first-year by means of the optional examinations may substitute in place thereof any prescribed or elective courses which he is qualified to pursue.

Examinations for advanced standing are held in such courses only as are intended primarily for undergraduates; and, among these, in such only as may reasonably be anticipated by examination. No laboratory course, no course in composition or discussion, and no other course in which an examination is obviously an inadequate test may be offered for admission to advanced standing.

Examination in Prescribed First-year English.

Composition: A. S. Hill's Principles of Rhetoric (edition 1895); Practice in writing. — *Literature:* Swift's Battle of the Books and Gulliver's Travels; Defoe's Robinson Crusoe (Part I); The Sir Roger de Coverley Papers in the Spectator; Pope's Rape of the Lock, Epistle to Arbuthnot, and Iliad I, VI, XXII; The lives of Swift, Defoe, and Pope in the English Men of Letters Series; Thackeray's English Humourists and Henry Esmond.

For another method of anticipating Prescribed first-year English (English *A*), see page 63.

NEW PLAN FOR AN ADMISSION EXAMINATION IN ENGLISH.

In 1900 and thereafter a candidate for admission to Harvard College or the Lawrence Scientific School may take an examination in English which, if he passes it with a grade higher than *D*, will exempt him from prescribed English in College. If he passes it with grade *D*, he will be required to take before the end of his Sophomore year a half-course in English Composition in addition to his regular elective courses.

The examination will consist of questions in Rhetoric,* questions in Literary History from the time of Shakspere, and compositions based on the following works:

Palgrave:
- Golden Treasury (First Series)

Shakspere:
- Julius Caesar
- The Merchant of Venice
- Macbeth
- Twelfth Night *or* As You Like It
- King Lear or Hamlet

Milton:
- L'Allegro
- Il Penseroso
- Comus

Bunyan:
- The Pilgrim's Progress, *or*

Defoe:
- Robinson Crusoe

Dryden:
- Alexander's Feast
- To the Memory of Mr. Oldham
- Upon the Death of the Earl of Dundee

Swift:
- The Voyage to Lilliput

Addison and Steele:
- The Sir Roger de Coverley Papers

Pope:
- Epistle to Arbuthnot

Goldsmith:
- The Vicar of Wakefield
- The Deserted Village

Scott:
- The Lady of the Lake
- Ivanhoe
- Quentin Durward

Macaulay:
- Life of Johnson
- Lays of Ancient Rome

Byron:
- Mazeppa
- The Prisoner of Chillon

Irving:
- The Legend of Sleepy Hollow
- Rip Van Winkle
- Tales of a Traveller

Thackeray:
- Henry Esmond

Dickens:
- A Tale of Two Cities *or* David Copperfield

Browning: Selections, for example,
- Cavalier Tunes
- The Lost Leader
- How They Brought the Good News from Ghent to Aix
- Evelyn Hope

* A. S. Hill's Principles of Rhetoric is used for the corresponding study in Harvard College, and is recommended for use in preparation for this examination.

Home Thoughts, from Abroad
Home Thoughts, from the Sea
Incident of the French Camp
The Boy and the Angel
One Word More
Hervé Riel
Pheidippides
Tennyson: Selections, for example,
Enid
Elaine
The Passing of Arthur
The Lady of Shalott
The Lotus Eaters
Ulysses
Tithonus
The Revenge
Franklin:
Autobiography
Hawthorne:
The House of the Seven Gables
Longfellow:
Tales of a Wayside Inn
Lowell:
The Vision of Sir Launfal

The candidate is expected to read all the books prescribed.* He should read them as he reads other books, — not trying to remember them in detail, but regarding each work as a whole and giving it such appreciation as shall enable him to write about it intelligently. In every case the examiner will regard knowledge of the books as less important than ability to write English; if the examination book in English affords insufficient evidence, he will examine the written work of the candidate in other subjects.

No candidate will be accepted in English whose work is seriously faulty in spelling, grammar, punctuation, or division into paragraphs.

Preparation for the examination should occupy at least three school hours, or periods, a week for four years. Throughout the course frequent short compositions should be required as well as occasional long ones. Topics should be chosen by the pupil himself whenever that is possible; and the topics assigned by the instructor should be within the range of the pupil's knowledge and sympathies, and should be such as to awaken interest and stimulate intelligence. Criticism should be constant and thorough; it should take account of merits as well as of faults, and should never interfere with the honest expression of opinion or with the free play of individuality in thought and expression. Mechanical methods of every kind should be avoided; and attention should be fixed on principles rather than rules.

As to the right way of studying Rhetoric, attention is called to the following extract from the Report of the Vassar Conference: †

"Though it is clear that the power to write a language can be obtained only by unremitting practice, yet, in the opinion of the Conference, such practice may properly be accompanied and illustrated by a course in elementary rhetoric. This course should include not only the principles

* In connection with the prescribed books, parallel or subsidiary reading should be encouraged, and a considerable amount of English poetry committed to memory.

† Report of the Committee of Ten, page 95, section 8.

of clearness, force, and good taste, but the principles of the arrangement of clauses in the sentence and of sentences in the paragraph. The teacher should bear in mind that any body of written English, of whatever length, is an organic unit, with principles that apply as well to the arrangement of the minor elements as to the grouping of the larger divisions of essay or book. Especial care should be taken that rhetoric is not studied by itself or for its own sake. Its connection with the pupil's actual written or spoken exercises should be kept constantly in view."

In 1900 the examination was held on Wednesday, June 27th, at all the places where other examinations for admission were held, and on Wednesday, September 19th, they will be held at Cambridge only. It will occupy three hours, beginning at 3 P.M.

A candidate who does not offer himself for examination according to the foregoing plan may prepare himself according to the plan set forth on pages 62 and 63. If he passes the examination according to this latter plan, he is not thereby exempted from the prescribed English of the Freshman year: but if he passes it with a grade of *A* or *B*, he is entitled to another examination (in September); and if he passes this second examination with a grade of *A* or *B*, he is exempted from prescribed English.

After 1903 the examination for the anticipation of English *A* (p. 73) will be withdrawn.

REGULATIONS CONCERNING ELECTIVE STUDIES.

The Courses of Instruction named in the Annual Announcement (called "Elective Pamphlet") are provided by the Faculty of Arts and Sciences for all the students under its charge, whether registered in Harvard College, in the Lawrence Scientific School, or in the Graduate School; and a student in either of these schools makes his choice of studies according to the regulations of the department to which he belongs.

A student in regular standing in the Lawrence Scientific School may obtain admission to a course offered in any other school of the University by presenting to the Dean of that school an application, on an official blank, certified by the Dean of the Lawrence Scientific School, and by giving satisfactory evidence of qualification for the course to the instructor who conducts it.

No student is admitted to any course offered by the Faculty of Arts and Sciences, unless he has fulfilled all the requirements for that course as stated in the Announcement, or otherwise satisfies the instructor that he is prepared to pursue it.

Every student must make his election so as to avoid conflict between the hours appointed for recitations or examinations in the courses which he chooses. No student will be examined in two courses of the same examination group, excepting half-courses not given in the same half-year, and a few courses specially mentioned in the Announcement.

The courses *for Undergraduates and Graduates* are, under certain limitations which are named in notes attached to the courses in the Announcement, open to any properly qualified student. But no starred (*) course may be taken by any student without the *previous consent* of the instructor.

No Scientific student is admitted to any course *primarily for Graduates* except on the written *recommendation* of the instructor. The Courses of Research and Seminary Courses may not be taken *by any student* without the *previous consent* of the instructor; and an undergraduate may not take in one year *more than one* Course of Research or Seminary Course.

Extra Studies.

A student who wishes, without assuming all the responsibilities of a regular study, to attend the instruction in any course, may do so on obtaining leave of the instructor; but no record will be kept of his attendance, and he will receive no credit in the College books for work done in the course. A course so taken is called an *Extra Study*.

Deficiencies.

A student whose record is deficient at the beginning of any year is expected to pursue during that year such studies, in addition to those otherwise required, as may be necessary to make up the deficiency, or such part of the deficiency as the Administrative Board of the Lawrence Scientific School may determine, in accordance with the Regulations; and these studies will be treated in all respects as part of his regular work.

A student wishing to make up a deficiency in a prescribed course by passing *the mid-year and final examinations* in that course must obtain the consent of the Administrative Board of the School, and must give the Recorder notice *before December 20* of his intention to take the examinations.

GRADES OF SCHOLARSHIP.

The standing of every student in each of his courses is expressed, on the completion of the course, according to his proficiency, by one of six grades, designated respectively by the letters *A*, *B*, *C*, *D*, *E*, *F*.

Grade *A* denotes that the student has passed the course with *high distinction;* grade *B* denotes *distinction;* grade *C* denotes that the student has *satisfactorily* passed the course; grade *D* denotes that the student has *barely passed* the course; grade *E* denotes *failure* to fulfil the requirements of the course; and grade *F* denotes a *serious failure.*

At the close of each academic year, a list of the courses given in that year under the authority of the Faculty of Arts and Sciences, and of all students who have attained Grade *A* or Grade *B* in any of those courses, is printed; the names for each of the two grades being arranged, for each course, in alphabetical order. This list is sent to the father or guardian of every student in the Lawrence Scientific School, and may be obtained by other persons, on application. The complete record of each student's work (including notice of failure in any course) is sent, at the same time, to his father or guardian, or to the student himself.

Every student is required to satisfy the instructor in each of his courses, in such way and at such times as the instructor may determine, that he is performing the work of the course in a systematic manner. The instructor will provide tests, with sufficient frequency to give effect to this regulation, and will at once report to the Recorder the names of students who have not satisfied him that they are doing their work systematically.

Any instructor, with the approval of the Dean of the Lawrence Scientific School, may at any time exclude from his course a student who in his judgment has neglected the work of the course. Such exclusion shall be

reported to the Administrative Board of the School at its next meeting. A student who has been excluded from any course may be required to place himself under the direction of a person approved by the Dean of the School.

DEGREES IN SCIENCE.

Degrees and Residence.

All degrees bestowed by the University are awarded by vote of the President and Fellows of Harvard College, with the consent of the Board of Overseers, and are publicly conferred by the President on Commencement Day.

The ordinary degrees, Bachelor of Science, Master of Science, and Doctor of Science, etc., are awarded by the Faculty of Arts and Sciences to students recommended for those degrees.

The Statutes of the University require that no person shall be recommended for any of the ordinary degrees, except after thorough public examination, and a residence at the University for at least one year.

No year is counted to a student by the Faculty of Arts and Sciences as a full year of study towards a degree which is not devoted to studies approved by the Faculty, or under its authority, as suitable and sufficient to be so counted.

Conditions of Candidacy.

In order to become a candidate for the degree of Bachelor of Science the student must be admitted to regular standing in one of the several four-year programmes of courses leading to that degree (see pp. 103–138).

Special students are not regarded as candidates for a degree.

Any Bachelor of Science of Harvard University is qualified to become a candidate for the degree of Master of Science or Doctor of Science. But the requirements of residence and study for those degrees must also be fulfilled.

A student in the Graduate School, or intending to enter it, not a Bachelor of Arts or Bachelor of Science of Harvard University, who wishes to become a candidate for the degree of Master of Science or Doctor of Science must make an application to the Committee on Admission from other Scientific Schools and Colleges, to be accepted as qualified for candidacy or to learn the conditions on which he may be so accepted. Application should be made by filling out a blank which may be obtained from the Secretary of the School. It should be accompanied by catalogues or calendars of the colleges or other institutions of advanced grade at which the student has previously studied, which must be marked so as to show clearly his course of study there; and also by certificates of his

scholarship at such institutions. The Committee will take into account, at their discretion, extra studies pursued by the applicant, studies pursued by him since graduation, teaching of advanced grade, and professional study. Early application to the Committee is recommended, in order that the student may have time to conform his plans of study to such conditions as the Committee may impose.

DEGREE OF BACHELOR OF SCIENCE.

In order to be recommended for the degree of Bachelor of Science, a student must have been registered in the Lawrence Scientific School as a candidate for that degree, at least one academic year.

The degree of Bachelor of Science is conferred upon any student who has fulfilled the requirements for that degree in any of the programmes of study organized in the Lawrence Scientific School.

The degree of Bachelor of Science *with distinction* is conferred in three grades: *cum laude*, *magna cum laude*, and *summa cum laude*.

The grade of the degree and the course of study for which the degree is given are specified in the diploma.

Graduation in Three Years.

If a student has anticipated studies amounting to a substantial portion of the work of the First-Year, and desires to fulfil the requirements for the degree in three years, he may apply to the Administrative Board for leave so to do, specifying in his application the manner in which he proposes to arrange his studies for that purpose. The Administrative Board will decide on such applications according to the circumstances in each case.

Honors.

Students in the Scientific School may be candidates for Honors at graduation on the same terms as students in Harvard College. See *University Catalogue*, 1899–1900, p. 446.

GRADUATION BOTH IN ARTS AND IN SCIENCE.

Students who wish to take the degree of Bachelor of Science in addition to the degree of Bachelor of Arts may register in the Lawrence Scientific School after their third year in Harvard College (or after the satisfactory completion of fourteen courses counting towards the degree of Bachelor of Arts). They may obtain the degree of Bachelor of Arts on the satisfactory completion of the required number of courses counting towards that degree, and the degree of Bachelor of Science after at least two years in the Scientific School.

It is desirable that students who contemplate taking their degrees in this way seek advice in the selection of their studies while registered in Harvard College, in order that they may enter the Scientific School fully prepared for the required work.

DEGREE OF MASTER OF SCIENCE.

The requirement for the degree of Master of Science for a Bachelor of Science or a Bachelor of Arts of Harvard University, or for any student who has been accepted, without special conditions, as qualified for candidacy for the degree on the ground of his previous studies, is at least *a full year of residence and study in the Graduate School, devoted to advanced work in science approved by some Division of the Faculty as affording suitable preparation for the degree and completed with high credit.* In every case the candidate must have satisfied the Division under which he wishes to work that he is qualified by his previous training to enter on the proposed course of study, which must form a consistent plan, with a definite aim in view, and while not necessarily lying wholly within one department or field, must be of such character that it can properly be referred to a single Division of the Faculty. The Divisions in which the degree may be obtained are those of Mathematics, Engineering, Physics, Chemistry, Biology, Geology, and American Archaeology and Ethnology.

Applications for approval of courses of study offered for the degree of Master of Science should be placed in the hands of the Dean of the Graduate School as early as possible in the year, and no such applications will be received after *the thirtieth day of April.*

DEGREE OF DOCTOR OF SCIENCE.

For the degree of Doctor of Science, *three years of scientific study,* approved as affording suitable preparation for the degree by the proper Divisional Committee on Honors and Higher Degrees, — at least *one* of these years being spent in *residence at this University,* — are required of students already qualified for candidacy for the degree. A student who holds the two degrees of Bachelor of Arts and Bachelor of Science from Harvard University is excused from one of the three years of study required for the degree of Doctor of Science.

For other regulations concerning candidacy for the degree of Doctor of Science, see the University Catalogue.

FELLOWSHIPS, SCHOLARSHIPS, AND PRIZES.

FELLOWSHIPS.

Graduates of the Scientific School may be appointed to the Parker Fellowships, the John Thornton Kirkland Fellowship, the Morgan Fellowships, and the John Tyndall Scholarship.

Students in the Scientific School may also be appointed to the Kirkland Fellowship and Tyndall Scholarship, and, if graduates of Harvard College, to any of the above Fellowships or to the Harris Fellowship. For full information, see *University Catalogue*, 1899–1900, pp. 471 et seq.

The Austin Fellowship in Architecture.

This fellowship, with an income of one thousand dollars, was established in 1899 by a vote of the President and Fellows, setting apart for the purpose a portion of the income of the fund received by the University under the will of Edward Austin of Boston.

The fellowship is open for competition to those who of their own means are not able to bear the expense of a year's study abroad. Candidates must be Bachelors of Science in Architecture of Harvard University, of not more than three year's standing at the Commencement next preceding the examination for the fellowship, and must have taken the degree *with distinction*. The selection among those admitted to candidacy will be made on the results of a competitive examination in the history of architecture and in design, to be held in Cambridge in the month of October of each year.

In the history of architecture each candidate will be examined on a special period to be selected by him in advance. Candidates must send notice of their choice of a period to the Professor of Architecture at least thirty days before the time set for the examination.

In the examination in design candidates will be required to present themselves at a special time and place, when the problem will be proposed to them and they will have eight hours for the preparation of preliminary sketches. These will be retained by the Department of Architecture for comparison with the final drawings. During the making of the preliminary sketches candidates will be under the supervision of an instructor of the Department. Candidates will be given three weeks

in which to prepare the final drawings, and will be required to present with them a written statement that they have been prepared without aid, direct or indirect, from other persons. The facilities of the Department will be free to candidates during the time of preparation of the final drawings.

Applications of candidates must be sent to the Secretary of the Lawrence Scientific School before the first day of September of the year in which they expect to present themselves for examination. The award will be made on the nomination of the instructors of the Department of Architecture acting in coöperation with the Committee appointed by the Board of Overseers to visit the Department.

The candidate who receives the fellowship will be required to spend at least one year in travel and study in Europe under the general direction of the Professor of Architecture. He will be required to send monthly reports of his progress, and to send at the end of each half-year a measured drawing of some monument of architecture which must be approved by the Department. He will also be required to make, during his stay in Europe, a special study of a single building or group of buildings, and on his return must present a written essay illustrated by drawings, embodying the results of his study.

SCHOLARSHIPS.

The scholarships are restricted, with a few exceptions, to resident students. Appointments are made by the President and Fellows of Harvard College, on nomination by the Faculty of Arts and Sciences.

Applications from students in the Lawrence Scientific School should be filed with the Secretary of the School on or before *June 1*.

Scholarships are awarded at the beginning of each academic year, to meritorious students standing in need of such assistance.

Payment of Income.

To resident holders of fellowships and scholarships having stipends, the income thereof is payable at the Bursar's Office, two-thirds *February 21*, and the remainder *one week before Commencement;* but the income will be first applied to the settlement of any College term-bills issued and unpaid, and any balance then remaining will be paid in money.

The income of non-resident fellowships, having stipends, is payable quarterly in advance by drafts sent from the Bursar's Office *September 1*, *December 1*, *March 1*, and *June 1*. The first payment of the year is due September 1 for the quarter ending November 30; but to any holder of a fellowship who is going abroad to study, the income for six months to

March 1 in the first year of his appointment will be paid at his request on or before September 1. No remittance will be made to the holder of a fellowship for any quarter until there is received from him at the Bursar's Office the address to which he desires to have it sent, unless he requests in writing that all remittances be sent to a stated address until he gives notice of a change.

The Austin Scholarships for Teachers (**H. C., L. S. S.**, and **G. S.***); eight, with an income of two hundred and fifty dollars each. Established in 1899 by a vote of the President and Fellows, assigning for the purpose a portion of the income of the fund received by the University under the will of Edward Austin, of Boston. These scholarships are open to persons who have attained established positions as teachers in colleges or secondary schools or as superintendents of schools and intend to return to service in the same or similar positions. Preference will be given in the assignment to applicants who have obtained leave of absence for one year for the purpose of studying at the University.

The Francis Hathaway Cummings Scholarship (**G. S., L. S. S.**, and **B.**); with an income of two hundred dollars. Founded in 1898, with a principal of five thousand dollars, by Charles A. Cummings and Margaret K. Cummings, in memory of their son, Francis Hathaway Cummings, of the Class of 1895. The income of this scholarship is "to be used for the benefit of students of proved merit who hold the degree of Bachelor of Arts from Harvard College, who need assistance, and who wish to pursue, either in the Graduates' School, the Lawrence Scientific School or the Bussey Institution a course of study in Applied Botany or in such other branches of the University teaching as will best prepare them for the profession of Landscape Gardener, or for the efficient practice of Horticulture, Arboriculture or Forestry."

The Joseph Eveleth Scholarships (**H. C.** and **L. S. S.**); five, with an income of two hundred dollars each. Founded from the residuary bequest, received in 1896, of thirty-seven thousand eight hundred and ninety-seven dollars and fourteen cents, made by Joseph Eveleth, of Boston and Watertown, Sheriff of Suffolk County from 1840 to 1855 except in 1853; "for aiding deserving and indigent young men in obtaining an education in said College or any of the schools connected therewith." Eight scholarships have been established on this foundation, of which three are assigned to the Lawrence Scientific School; three to the Medical School; and two to Special Students in Harvard College.

* In this list the letters H. C., L. S. S., G. S., and B. indicate that the scholarship is open to students in Harvard College, the Lawrence Scientific School, the Graduate School, and the Bussey Institution, respectively.

The Hilton Scholarships (**H. C.** and **L. S. S.**); two, with an income of two hundred and twenty-five dollars each. Founded in 1897, from a bequest of William Hilton. Three scholarships exist on this foundation; of which one is assigned to Harvard College, one to the Lawrence Scientific School, and one to the Medical School.

The Hennen Jennings Scholarship (**L. S. S.**); with an income of four hundred dollars. Founded in 1898, with a principal of ten thousand and seventy-two dollars and forty cents, by Hennen Jennings, a graduate of the Lawrence Scientific School in the Class of 1877. The full yearly interest of this fund is to be used for one scholarship, and is not to be given "merely as a charity to mediocre ability," or to "students whose own private means are sufficient for all their requirements."

The Normal School Scholarships (**L. S. S.**); not exceeding eight at any one time, with an income of one hundred and fifty dollars each. Maintained by the University, under a vote of the President and Fellows passed March 8, 1880, for the benefit of students in the Lawrence Scientific School who are graduates of reputable Normal Schools in the United States.

The University Scholarships (**L. S. S.** and **G. S.**); thirty-six, with an income of one hundred and fifty dollars each. Maintained by vote of the President and Fellows of Harvard College; sixteen being assigned to the Lawrence Scientific School, and twenty being assigned to the Graduate School.

PRIZES.

Students in the Lawrence Scientific School may compete for the Bowdoin, Dante, Sales, and Sumner Prizes, for full information in regard to which see *University Catalogue*, 1899–1900, p. 462 *et seq.*

OTHER SOURCES OF AID.

LOAN-FUNDS.

In addition to the scholarships, which are enumerated in the preceding section (see pp. 83–85), the following funds have been established.

The Edward Austin Fund. In 1899, the sum of four hundred and twenty-five thousand dollars was received by the College in the settlement of the bequest of five hundred thousand dollars, made by Edward Austin, who gave Austin Hall to the Law School, the income thereof to be paid to "needy, and meritorious students, teachers to assist them in payment of their studies." Two thousand dollars of this fund is loaned to students in the Lawrence Scientific School.

Stuart Wadsworth Wheeler Fund. In 1898, Mrs. Susan Wheeler gave to the College as a memorial to her son, Stuart Wadsworth Wheeler, a former student in the University and a soldier in the Spanish War, five thousand dollars "towards the fund for helping poor students." The income of this fund has been placed by the Corporation at the disposition of the Dean of the Lawrence Scientific School, to whom application should be made.

OPPORTUNITIES FOR EARNING MONEY.

Opportunities frequently present themselves by which students who need to increase their income may obtain, in term-time or in vacation, employment of various kinds, such as typewriting, stenography, canvassing, office work, newspaper work, singing, and, after the first year, private tutoring. Students who wish to be regarded as applicants for such employment should register their names, with a statement of their qualifications and of the kind of work they desire, with the *Recording Secretary*, No. 5, University Hall.

FEES AND EXPENSES.

TUITION-FEES.

The annual tuition-fee for every student in regular standing in the Lawrence Scientific School *is one hundred and fifty dollars.* The same fee is charged to Special Students doing full work. Laboratory fees must be paid in addition to the tuition-fee by students who take laboratory courses.

A student paying this fee is entitled to all the general privileges of membership in the University. He has the right to take any courses for which he is qualified, given under the authority of the Faculty of Arts and Sciences; but in laboratory courses he must pay certain additional fees, named below. He has also the right of free admission, provided he is properly qualified, to any of the instruction and the examinations given in any department of the University; except exercises carried on in special laboratories. To obtain admission to instruction given in a department not under the charge of the Faculty of Arts and Sciences, a Scientific student should apply to the Secretary of the Scientific School for a certificate to be presented to the Dean of the department in which the desired instruction is given.

The first third of the academic year begins with the academic year, and ends *December 31.* The second third begins *January 1* and ends *March 31.* The last third begins *April 1* and ends at *Commencement.*

A student who enters the University after the beginning of the academic year is charged for instruction from the beginning of the third in which he enters. One who withdraws during the year is charged to the end of the third in which he leaves, if before that time he gives written notice of his withdrawal to the Dean of the department in which he is registered, or to the Recorder; otherwise he is charged to the end of the third in which such written notice is given.

Deduction from the full tuition-fee of one hundred and fifty dollars a year is made for properly notified absence, as follows: for absence for three consecutive months, *thirty dollars;* for absence during the whole year, not including the mid-year and final examinations, or either of them, *one hundred dollars.* A student who claims a deduction, on the ground of absence, must present at the Bursar's office a certificate from the

Recorder as to the fact and duration of his absence; and in order to obtain such a certificate, he must have given previous notice of his intended absence to the Recorder.

A fee of *three dollars* is charged for the second and each subsequent examination for removing a condition.

Fees for Single Courses.

Special Students may pay fees for the courses which they take, instead of paying the full tuition fee of a student in regular standing. But a student paying less than one hundred and fifty dollars is not allowed to be the holder of a fellowship or scholarship, or to count the year as a full year of study for a degree, or to claim admission to instruction or examination in another department of the University.

The fees for single courses are as follows: —

For any Course of Instruction, not a Laboratory Course or Course of Research, and for any Laboratory Course designed "primarily for Undergraduates;" *forty-five dollars* for a full course, *twenty-five dollars* for a half-course.

For a Laboratory Course designed "primarily for Graduates" or "for Undergraduates and Graduates," *one hundred and fifty dollars*.

For a Course of Research, such amount, *not less than forty-five dollars*, as shall represent the weight of the course in the student's plan of work.

In all other cases the fee is computed at the rate of *fifteen dollars for an hour a week* of instruction during the academic year, up to one hundred and fifty dollars.

In no case shall the tuition-fee for the year be less than *thirty dollars* or more than *one hundred and fifty dollars*.

No deduction for absence or withdrawal is made from the fees for single courses. A student who attends a Course of Instruction for only a part of the year must pay the whole fee for such course. But a student who is liable for the full tuition-fee of *one hundred and fifty dollars* a year is entitled to the same remission as a student in regular standing.

Laboratory Fees.

Every student who takes a Laboratory Course must pay, in addition to his tuition-fee, the special fees pertaining to such courses. For each Laboratory Course in Physics, the fee is *ten dollars*, which covers all charges. For study in the Chemical and Mineralogical Laboratories, there is a general fee, which varies from *five dollars* to *thirty dollars*, according to the nature and amount of the work undertaken, and also an individual fee for the use of materials in special investigations and for

breakage, and in payment of fines for violation of the laboratoy regulations. For Laboratory Courses in Psychology, in Botany, Zoölogy, and Geology (except Mineralogy and Petrography), and in Hygiene, the fee is *five dollars*, which covers all charges. For instruction and the use of the work shops in the Rindge Manual Training School, the fee is *fifteen dollars*.

BONDS.

Every Student in the Lawrence Scientific School must file with the Bursar a bond in the sum of *two hundred dollars*, signed by two bondsmen, one of whom must be a citizen of the United States, or by a surety company duly qualified to do business in Massachusetts, as security for the payment of College bills; or he may deposit with the Bursar four hundred dollars in money or in United States bonds, for the same purpose; or he may deposit *fifty dollars* as security, and pay his tuition-fees in advance as follows: — one third on or before *October 1*, one third on or before *January 1*, and one third on or before *April 1*.

Every student in any department of the University who occupies a College room or boards at Memorial Hall or Randall Hall must file a bond for *four hundred dollars*, or must in advance, and in addition to his tuition-fees, pay the full year's rent of his room, and make a deposit as security for the payment of his board at the rate of *five dollars a week*.

No officer or student of the University is accepted as a bondsman.

BILLS.

The first term-bill, containing two-thirds of the annual charges, is issued February 1; and must be paid on or before *February 21*.

The second term-bill, containg the remaining third of the annual charges, is issued one week before Commencement; and must be paid by a candidate for a degree at least *one day before Commencement*, and by other students on or before *October 10*.

When a student withdraws from the University, his whole bill becomes payable at once.

EXPENSES.

The following table exhibits four scales of annual expenditure: —

	Low.	Moderate.	Liberal.	Very liberal.
Tuition	$150	$150	$150	$150
Room (one-half)	30	50	100	200
Furniture (annual average)	10	15	25	50
Board (39 weeks)	117	160	160	390
Fuel and light	11	15	30	45
Sundries	40	60	100	200
Total	$358	$450	$565	$1035

The above estimates do not include laboratory charges, books and stationery, clothing, washing, membership of societies, subscriptions, service, and the expenses of the long vacation; some of which are luxuries, and all of which vary with the means and habits of the individual student. The exceptionally strong and capable student can, without injury to himself, reduce his necessary expenses below the lowest estimate presented in the above table, which may be regarded as a fair one for a student of ordinary constitution and power of self-command. A single room is naturally more costly than one shared by two persons; but single rooms, not in the immediate vicinity of the University, may be obtained for moderate rents. A list of available rooms is issued each year by the Committee on the Reception of Students, and may be obtained in the course of the summer, from the Corresponding Secretary or at the Publication Office.

A committee of officers and students have charge of some hundred sets of chamber and study furniture which are rented at low rates.

Members of any department of the University can board at cost by joining the Association which uses the great dining-room of Memorial Hall, but the total membership is necessarily limited to about 1100. The cost of board to the members of this association is expected not to exceed $4.15 a week. Applications for seats for the year 1900–01 should be made before September 15, 1900, to the Auditor of the Dining Association, Memorial Hall. The Hall opens on the last Wednesday in September.

Upwards of seven hundred members of the various departments of the University are admitted annually to the Randall Hall Association, a coöperative organization having quarters adjoining the College Yard.

Simple articles of food are furnished to order at cost, making it possible to board at this Association for from $2.50 to $3.00 a week. The annual fees of the Association are low. Application should be made early to the Secretary of the Randall Hall Association.

The Harvard Coöperative Society is another organization for reducing expenses. At the store of the Society, clothing, books, stationery, wood, coal, etc., can be purchased at reduced prices.

For important information on the subject of expenses, persons intending to come to the University are advised to consult a pamphlet entitled *Students' Expenses*, of which copies may be obtained from the Corresponding Secretary or at the Publication Office.

ASSIGNMENT OF COLLEGE ROOMS FOR 1900–01.

Students living in College buildings, who intend to be students in any department of the University during the academic year 1900–01, and wish to engage for that year the rooms which they now occupy, must sign new room-agreements and leave them at the Bursar's office between March 21 and March 31 inclusive.

A list of all the College rooms not engaged for 1900–01, except rooms in Wadsworth House, and a few rooms in Holyoke House, with blank forms of application, will be ready for delivery at the Bursar's office April 6. Applications for these rooms may be made on or before May 2 by those who intend to be students in the University during the year 1900–01. But rooms in Holworthy Hall will be assigned by preference to applicants who are members of the classes of 1901, 1902, or 1903, in the College; and rooms in Hollis, Stoughton, Thayer, Weld, Grays and Matthews will be assigned by preference to members and graduates of the College and of the Scientific School, and to applicants who intend to enter either of those departments as Undergraduates during the summer of 1900. Applications which are not made on the printed blanks, and applications from those who have already engaged College rooms for 1900–01, will not be considered. The assignment of rooms will be made by lot May 4, and the result of the allotment will be announced May 5.

Lists of the rooms to be let May 4, descriptive lists of rooms, blank applications and bonds will be sent after April 6 to those intending to enter the University in the summer of 1900 who send their names and addresses to the Bursar for that purpose. The application will contain a certificate to be signed by the instructor of the applicant stating that the applicant intends to enter the University in the summer of 1900, and specifying the department he intends to enter, and the examinations (June or September) at which he will apply for admission. The bond for $400 must be executed by two sufficient bondsmen or by a surety company duly qualified to do business

in Massachusetts, and will hold them for the full year's rent of any one of the rooms applied for which may be assigned to the applicant between the date of the execution of the bond and the fifth day of October, 1900, unless the applicant is rejected at the June examinations without permission to take the examinations in September; and in that case the bondsmen will be held for one quarter of the full year's rent. But the bondsmen will not be held for any payment of rent if the Bursar lets the room to some other member of the University in accordance with the established rules.

In the assignment of a room with two bedrooms,* preference will be given to an application signed by two students who will occupy the room together. If two students, neither of whom has a room standing in his name for 1900–01, intend to occupy a room together and both sign one application, this application will be given two chances in the allotment and any room drawn will be assigned to the two applicants. But if in any case one of two applicants to whom a room has been assigned is not admitted to College at the examination specified by the instructor on the room-application, or if either of the applicants does not register and join his class before October 1, or does not occupy the room through the year, the Bursar may cancel the assignment and assign the room by lot to other applicants.

Every student to whom a room is assigned, except any applicant for admission who is rejected at the June examinations without permission to take the examinations in September, will be held responsible for the full year's rent thereof, and all charges for gas and damages, unless, before October 1, 1900, the room is let at his request to some other student in accordance with the established rules; or unless, being a member of the class of 1901, of 1902, or of 1903, in the College, he permanently severs his connection with the University, obtains a leave of absence for the whole year 1900–01, or is suspended for the whole of that year, and gives written notice to the Bursar before September 1, 1900, that he desires to cancel his room-agreement. When one of two room-mates cancels his room-agreement under the preceding provision, the other room-mate may, except as otherwise provided in the case of rooms assigned by preference to two applicants, secure the room by at once signing a new room-agreement and leaving it at the Bursar's office; but unless he does so, the Bursar will be at liberty to assign the room to other tenants.

Students who have no College rooms for 1900–01 and wish to obtain rooms which may be unengaged May 9, or which may become vacant at any time after that date, may after May 5 file applications at the Bursar's office, specifying the conditions as to buildings, floors, exposure, rent, &c. which they desire to have met and containing agreements to take any rooms which may be assigned to them which fulfil the specified conditions. These applications will remain in force until such dates as the applicants

* In Holyoke House, rooms 5, 16, 27, and 38 only, will be subject to this preference.

may specify therein, and rooms will be assigned upon them by lot. Notice of rooms to be assigned may be put upon the bulletin board if the Bursar considers it advisable.

The Bursar may cancel the assignment of a room to one whose connection with the University as a student is terminated; or to one intending to enter College as an undergraduate, who does not pass the admission examination or, having passed the examination, does not join his class before October 1, 1900; or to any other person who does not register as a student in some department of the University before October 1, 1900.

The right to occupy a College room is given only to the student to whom the room is assigned and to his room-mate. Neither transfers nor exchanges of rooms are allowed. Not more than two students are allowed to occupy any College room; and not more than one to occupy any room in Divinity Hall except those having bedrooms, nor any room on the North side of Grays Hall, nor Nos. 18, 30, and 42 in Conant Hall. Only the constant use of a room by night as well as by day will be regarded as occupation thereof. All persons who occupy College rooms are subject to the regulations of the Parietal Board. Persons not connected with the University are not allowed to occupy College rooms. Tenants who desire to employ any one to make fires, black boots, etc., must arrange therefor with the porters of the buildings in which they live.

PRICES OF COLLEGE ROOMS FOR 1900–01.

In each case the price is for the whole room from the beginning of the Academic Year until the next Commencement, and includes the daily care of the room.

$30. College House, No. 35.

$40. Divinity Hall, No. 10, Divinity House, No. 4.

$45. Divinity Hall, No. 5.

$50. College House, Nos. 57 and 58; Divinity Hall, Nos. 2, 3, 6*, 14.

$55. College House, No. 66; Divinity Hall, Nos. 1, 4*, 9*, 12*, 13; Divinity House No. 2.

$60. College House, Nos. 22, 44; Divinity Hall, Nos. 11*, 20; Divinity House, No. 5.

$65. Grays, Nos. 33, 35; College House, Nos. 46, 48, 50, 52, 54, 60, 62, 64; Divinity Hall, Nos. 18, 28; Divinity House, No. 1.

$70. College House, Nos. 3, 4, 6, 7, 8, 9, 10, 15, 16, 18, 19, 20, 25, 26, 27, 28, 30, 31, 32, 37, 38, 39, 40, 41, 42; Divinity Hall, Nos. 7*, 8*, 24*, 34*, 35, 36, 38*.

$75. Hollis and Stoughton, Nos. 1, 2, 3, 4, 18, 19, 20; Stoughton, No, 17; College House, Nos. 47, 49, 51, 53, 59, 61, 63, 69, 70; Divinity Hall, Nos. 26*, 32*, 40*, 41, 42*; Divinity House, No. 3.

* Rooms thus (*) designated are furnished with bedstead, spring, mattress, pillow, washstand, chiffonnier, desk, chairs, bookshelves, and rug. The other rooms are unfurnished.

$80. Grays, No. 34; College House, Nos. 11, 33, 45, 55, 65, 67, 68; Divinity Hall, Nos. 15, 17, 19, 21*, 22*, 23, 25, 29, 31, 33, 37, 39.

$85. Grays, Nos. 13, 15, 49, 51; College House, Nos. 1, 2, 21, 23, 24, 43; Divinity Hall, Nos. 16*, 27*, 30*.

$90. Weld, Nos. 25, 26, 52, 53; Grays, Nos. 3, 17, 19, 37.

$95. Hollis and Stoughton, Nos. 13, 14, 16.

$100. Hollis and Stoughton, Nos. 5, 6, 8, 9, 10, 11, 12, 22, 23, 24, 26, 27, 28; Hollis, No. 21; Stoughton, No. 25; Holyoke, Nos. 39, 45; Foxcroft, Nos. 6, 15; Walter Hastings, No. 61; Wadsworth, Nos. 9 and 10, 11 and 12.

$105. Hollis and Stoughton, Nos. 29, 32; Grays, No. 36.

$110. Grays, Nos. 14, 29, 31.

$115. Grays, Nos. 1, 11, 18, 25, 27, 39, 45; College House, No. 29.

$120. Weld, Nos. 24, 27, 51, 54; Grays, No. 21.

$125. Hollis, No. 17; Weld, Nos. 9, 36; Matthews, Nos. 27, 28, 57, 58; Holyoke, No. 28; Foxcroft, Nos. 1, 2, 3, 4, 5, 9, 10, 11, 14; Gannett, No. 7; Walter Hastings, Nos. 13, 22, 23, 32, 46, 59; Perkins, Nos. 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22; Conant, Nos. 18, 30, 42.

$130. Hollis and Stoughton, Nos. 30, 31; Thayer, Nos. 17, 18, 19, 20, 41, 42, 65, 66.

$135. Thayer, Nos. 23, 24, 47, 48; Grays, Nos. 16, 30, 50, 52.

$140. Grays, Nos. 2, 9, 26, 40, 47.

$145. Grays, No. 22.

$150. Hollis, Nos. 15, 25; Stoughton, No. 15; Holyoke, Nos. 2, 3, 6, 11, 17, 40, 44, 46; Foxcroft, Nos. 7, 12, 13; Gannett, No. 9; Walter Hastings, Nos. 45, 60; Perkins, Nos. 1, 2, 25, 26, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 61, 62, 63, 64, 65, 66, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88.

$160. Thayer, Nos. 13, 14, 15, 16, 35, 36, 43, 44, 59, 60, 67, 68; Grays, No. 32; Matthews, Nos. 25, 26, 29, 30, 55, 56, 59, 60.

$165. Thayer, Nos. 1, 2, 3, 4, 63, 64; Grays, Nos. 4, 10, 12, 20, 28, 38, 46, 48; Matthews, No. 6.

$170. Thayer, Nos. 25, 26, 49, 50; Grays, Nos. 6, 8, 42, 44.

$175. Thayer, Nos. 45, 46; Holyoke, Nos. 12, 29, 34; Foxcroft, No. 8; Perkins, Nos. 23, 24, 45, 46, 67, 68.

$185. Weld, Nos. 3, 5, 13, 14, 19, 20, 30, 32, 40, 41, 46, 47.

$190. Thayer, Nos. 5, 6, 8, 9, 10, 11, 12, 37, 38, 39, 40, 57, 58, 61, 62; Weld, Nos. 8, 34; Matthews, Nos. 9, 15, 39, 45.

* See foot-note on preceding page.

$200. Thayer, Nos. 21, 22, 31, 51, 52, 56; Holyoke, Nos. 18, 22, 23, 37, 41, 42, 43, 47, 48; Gannett, Nos. 3 and 4, 6; Conant, Nos. 3, 4, 5, 7, 8, 9, 10, 11, 12; Wadsworth, Nos. 1 and 2, 13, 14.

$215. Matthews, Nos. 22, 32.

$220. Thayer, Nos. 33, 34; Weld, No. 1; Matthews, Nos. 3, 4, 33, 34.

$225. Thayer, Nos, 27, 28, 32, 55; Matthews, Nos. 10, 16, 46; Holyoke, Nos. 1, 26, 30, 31, 32, 35, 36, 50; Gannett, Nos. 1, 2; Walter Hastings, Nos. 20, 30, 42; Conant, Nos. 1, 2, 15, 16, 19, 20, 21, 22, 23, 24, 27, 28, 29, 31, 32, 33, 34, 35, 36, 39, 40, 41, 43, 44, 45, 46, 47, 48; Wadsworth, No. 5 and 6.

$240. Weld, Nos. 18, 21, 22, 23, 45, 48, 49, 50.

$245. Weld, Nos. 4, 12, 15, 39, 42; Matthews, Nos, 19, 20, 21, 49, 50, 51.

$250. Weld, Nos. 6, 31. 33; Matthews, No. 5; Holyoke, Nos. 4, 9, 10, 13, 14, 15, 20, 21, 24, 25, 38, 49; Gannett, Nos. 5, 8; Walter Hastings, Nos. 14, 16, 18, 24, 26, 28, 33, 36, 39, 47, 50, 53, 56; Conant, Nos. 13, 14, 25, 26, 37, 38; Wadsworth, Nos. 3 and 4, 7 and 8, 15.

$265. Matthews, Nos. 23, 24.

$270. Weld, Nos. 16, 17, 43, 44.

$275. Holworthy, Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24; Weld, Nos. 2, 10, 11, 28, 29, 37, 38; Matthews, Nos. 1, 2, 8, 13, 14, 31, 32, 35, 36, 37, 38, 43, 44; Holyoke, Nos. 8, 19.

$290. Matthews, Nos. 53, 54.

$300. Holyoke, Nos. 5, 16, 27; Walter Hastings, Nos. 12, 21, 35, 38, 41, 44.

$325. Matthews, Nos. 11, 12, 17, 18, 41, 42, 47, 48; Walter Hastings, Nos. 3, 6, 9, 11, 15, 17, 19, 25, 27, 29, 31, 34, 37, 40, 43, 57, 58.

$350. Walter Hastings, Nos. 1, 2, 4, 5, 7, 8, 10, 48, 49, 51, 54, 55.

Divinity Hall and House.

Divinity Hall and Divinity House are reserved primarily for students of the Divinity School, and rooms in those buildings will not be assigned to other students until the Thursday on which the academic year begins. Applications by students not of the Divinity School for rooms that shall remain unlet on that date, may be filed with the Bursar during the summer, but such applications must be accompanied in all cases by a written statement from the Dean of the Divinity School that the applicant is approved by him. Applicants who are not known to the Dean should present to him letters of introduction from some officer of the University, or other person qualified to give them.

REGULATIONS.

PETITIONS.

1. Every request from a student to the Administrative Board should be made in writing, and should be addressed to the Dean of the School.

REGISTRATION AND RESIDENCE.

2. Every student is required to present himself for registration not later than Thursday, the first day of the academic year, between 9 A.M. and 1 P.M.., at a place announced on the bulletin boards of the School. He is further required to register not later than 1.30 P.M. on the first week-day after the Christmas recess and the first week-day after the April recess.

Special Scientific Students who are already members of the School, and candidates whose applications have been approved by the Board, will present themselves for registration on the same days and at the same place as students in regular standing.

3. Continuous residence at the University during term-time is required. No interruption of residence is permissible, except for satisfactory reasons stated to the Secretary (orally, if possible) before the student leaves Cambridge. The student who has been absent must immediately on his return report in person to the Secretary.

SCHOOL EXERCISES.

4. A student prevented by illness or other cause from attending School exercises for a day or more must send notice to the Secretary without delay. Immediately on his return to duty, he must make, at the Secretary's office, a specific statement of the cause of his absence; and, if his explanation is satisfactory, his absence will be excused.

5. A student who fails to give an instructor a theme, forensic, or other written exercises at the appointed time will get no credit for it, unless he satisfies the Secretary that the delay was caused by serious illness or other unavoidable hindrance.

6. A student who has neglected the work of any course may, with the approval of the Dean, be excluded from the course by the instructor.

ENROLMENT.

7. Every student is required to hand to the officer with whom he registers at the beginning of the academic year a list of his studies *for the whole year*. This list must be written on a card provided for the purpose, and must be signed by his Adviser.

At the same time and on the same card, every student is required to enroll himself in each of his studies which begin in the first half-year, whether prescribed or elective.

8. It is of the utmost importance that the student should have fully considered and decided upon his plan of study before the first day of the year, as changes, either additions to, or subtractions from the lists then handed in, are not allowed except for causes which could not have been foreseen. Changes may be made only with the approval of the Adviser and permission of the Dean, to whom application must be made in writing (on a blank form to be obtained at the office) with a full statement of reasons.

9. A student who has obtained leave to change his studies must enroll with the Secretary immediately upon receiving notice that the change has been permitted.

The exercises are held at the hours set down in the Announcement and at places to be announced on the bulletin boards.

EXTRA STUDIES.

10. A student who wishes, without assuming all the responsibilities of a regular study, to attend the instruction of any course, may do so on obtaining leave of the instructor; but no record will be kept of his attendance and he will receive no credit in the course.

ANTICIPATORY EXAMINATIONS.

11. Students who have anticipated studies in the Four Years' Programme in which they are registered, shall take such other studies as the Administrative Board may designate.

CONDITIONS AND DEFICIENCIES.

12. A candidate may be admitted with conditions in some of the admission subjects; but no candidate so admitted will be advanced to Third-Year standing in the School until he has made good such conditions to the satisfaction of the Administrative Board.

The exact number of conditions with which a candidate may be admitted cannot be named in advance; each case is considered on its merits.

13. Students who have not received official notice of having passed all of the admission examinations in Mathematics must obtain the signature of the instructor of the First-Year Mathematics before registration, in order to be allowed to enroll in the mathematical courses.

14. No student in the Engineering courses will be advanced to Second-Year standing until all his admission conditions in Mathematics are made good to the satisfaction of the Administrative Board.

15. Students of Mechanical and Electrical Engineering of the First-Year who have any admission condition, and those of the Second-Year who have either condition or deficiency will not be allowed to take the work-shop courses during term-time, but will be required to take them during the following summer.

PROMOTION.

16. In order to be promoted to a higher class at the end of a school year, a student must have attained in that year grade *C* or higher in at least one half of his required work, and must not have an aggregate deficiency of more than two courses.

17. A student who has failed in any course of prescribed study must make up the deficiency by taking the same course in some following year, and he is barred from dependent courses until such deficiency is made good.

18. A student who has failed of promotion under the operation of rule 16 will be placed on probation unless the Dean is satisfied that the failure to be promoted is not due to neglect.

19. To obtain credit in a course of study, or to count the course towards fulfilment of the requirements for a degree, the student must have attended both the mid-year and the final examinations. This rule applies to all students, including suspended students and students on leave of absence.

SPECIAL STUDENTS.

20. At the beginning of each year special students must submit their choice of studies for approval. They will be required to take each year four full courses selected from among the following: Courses in Mathematics, Engineering, Physics, Chemistry, Geology, Botany, or Zoölogy, and any courses in other departments which are prescribed in the several programmes of study for the degree of S.B.

21. At least one half of the work of each special student must be taken from the regular programme in which he registers.

22. Candidates who cannot otherwise show that they are competent to pursue subjects which are protected by entrance examinations, must pass satisfactory tests before entering these courses.

23. Exceptional cases may be submitted to the Administrative Board by petition.

EXAMINATIONS.

24. A student who has been absent from a mid-year examination, and has satisfied the Secretary that his absence was caused by serious illness or other unavoidable hindrance, is entitled to a second and last opportunity of passing the examination at some time during the period of the final examinations, provided he make written request for such examination before May 1.

25. A student who, having passed the mid-year examination in any course of study, has been absent from the final examination, and has satisfied the Secretary that his absence was caused by serious illness or other unavoidable hindrance, is entitled to a second and last opportunity of passing the examination at some time during the first fortnight of the ensuing academic year, provided he make written request for such examination before September 10.

26. No student is permitted to take any books or papers into an examination room except by express direction of the instructor. No communication is permitted between students in an examination room on any subject whatever.

27. If a student is tardy at an examination, he may not be admitted to it, and may be reported as absent.

GOOD ORDER.

28. No student shall lodge or board in any house disapproved by the Regent, or change his lodging without giving immediate notice to the Secretary.

29. No student shall refuse to give his name to an officer of the University. Every society of students shall give the Regent, at his request, a complete list of its officers and members.

30. No dramatic or musical society shall take part in an entertainment for money or out of the limits of Old Cambridge without permission of the Faculty Committee on Dramatic and Musical Entertainments.

DISCIPLINE.

31. Neglect of School work and offences against law and order will be dealt with as the Faculty or the Administrative Board shall determine. Discipline may be enforced by Admonition, Probation, Suspension, Dismissal, or Expulsion.

Admonition includes a warning notice to parent or guardian.

Probation indicates serious danger of separation from the University. A student on probation is not allowed to compete for scholarships, prizes, or honors, or to take part — whether with students or with other persons — in any public theatrical or musical performance or in any public athletic contest; he cannot be restored to full standing without a special vote of the Administrative Board, and he cannot be recommended for a degree; he may be required to put himself under the direction of a private tutor approved by the Dean, or to report daily to an officer of the University, or to do both; and at any time, by vote of the Administrative Board, his probation may be closed and his connection with the University ended.

Suspension is temporary separation from the University, and may involve residence in a specified place and performance of specified tasks. A suspended student is not allowed to reside in Cambridge without the permission of the Administrative Board, or to visit Cambridge without the permission of the Dean, excepting at the period of the mid-year and final examinations. A suspended student is not allowed to take part in the public performances or games of any University association.

Dismissal closes a student's connection with the University, without necessarily precluding his return.

Expulsion is final separation from the University.

FOUR-YEAR PROGRAMMES OF COURSES.

The courses included in the following twelve programmes are selected mainly from the Courses of Instruction provided by the Faculty of Arts and Sciences and described in the University Catalogue, under the headings which are here given in the parentheses.

The numbers and letters prefixed to the several courses are intended to be permanent, and no attempt is made to arrange them in a regular or complete series.

The Roman numeral in parenthesis appended to each course indicates the examination group to which the course belongs.

PROGRAMMES IN ENGINEERING.

General Statement.

All instruction in Civil and Topographical, Mechanical, and Electrical Engineering is given under the immediate direction of a division of the Faculty of Arts and Sciences, known as the Division of Engineering.

Degrees in Engineering (S.B. and M.S.) are conferred upon satisfaction of certain requirements of the Lawrence Scientific School, and of the Graduate School.

More than half of the courses in Engineering count toward the degree of A.B., and hence may be elected by students in Harvard College. This enables students who desire to obtain the degree of A.B. in addition to the degree of S.B. to obtain both degrees in five years after entering College (see p. 80).

Buildings and Equipment.

The Engineering laboratories are freely used in connection with all subjects which require models or machinery for clear and comprehensive treatment, and are at the service of graduate students for conducting investigations in Strength of Materials, Hydraulics, Steam, and Electricity.

The lecture rooms, draughting rooms, and laboratories for the instruction in engineering are situated in Lawrence Hall and in the Rogers Building.

The Engineering Library and Reading Room, located on the second floor of the Lawrence Hall, contain more than 5000 volumes on engineering subjects, and are supplied with all the important foreign and American engineering periodicals.

The Instrument Room contains Transits, Levels, Solar Compasses, Plane Tables and Hand Levels, Rods, Tapes, Chains, etc.

The Heat-Engine Equipment includes steam, gas, oil, and hot air engines, blower, air compressor, boiler, and condensor as well as apparatus for investigations of their action and efficiency, and for standardizing the instruments used.

For Testing Materials the laboratory contains a 200,000 lb. autographic machine capable of testing tension and compression pieces up to 4 ft. in length, and beams up to 20 ft., and several other machines, including cast iron and cement testing machines and their accessories. There is also a special laboratory for the testing of road material.

The Hydraulic Plant includes a pump with a capacity of about 1000 gallons per minute, supplying water to a closed stand pipe. Any head up to 300 feet can be obtained in the stand pipe by compressing air above the water, and can be maintained constant. The discharge from the stand pipe takes place through an opening to which a turbine orifice or other apparatus can be attached. The water can be measured over a weir or by direct weighing.

The laboratory also contains apparatus for investigations in friction, lubricants, fuels, and the transmission of power by ropes or belts.

The Electrical Engineering Laboratory includes two dynamo laboratories, a standardizing and instrument room, a storage-battery room, an arc-lamp room, a photometer room, and a shop for the construction and repair of apparatus, all well equipped.

Besides a considerable variety of dynamos, motors, and transformers of standard makes, there are several machines designed by the students. Among these are a three-phase induction motor with several armatures (for secondaries) exhibiting different characteristics; a three-speed shunt motor operating a 30 inch lathe; and a 40,000 volt transformer for insulation tests.

For the shopwork courses the building and equipment of the Rindge Manual Training School are used by the Division.

Engineering Building.

Ground has been broken for a new Engineering Building. It will contain laboratories, draughting rooms and lecture rooms for all engineering courses. It is expected that this building will be ready for use in the fall of 1901.

CIVIL ENGINEERING *

The degree of Bachelor of Science in Civil Engineering will be conferred on students who complete this programme and pass the required examinations satisfactorily.†

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Tu., Th., at 10, and an additional hour for conference. Second half-year.*
Or, II, *Mon., Wed., at 11, and an additional hour for conference. First half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

Descriptive Inorganic Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30*, or *Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German or French. One full course in addition to the admission requirements, so chosen as not to conflict with other prescribed courses.

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* For those only who did not present Physics for admission. (I and V)

Surveying (Engineering 4*a*).‡
Four weeks in summer.

Geodetic Surveying (Engineering 4*c*).‡
Two weeks in summer.

Railroad Engineering (Engineering 4*d*).‡
Three weeks in summer.

* See also Regulations, p. 98.

† Students of Civil Engineering are advised to take in addition to this programme the Shopwork Courses, Engineering 10*a*, 10*b*, 10*c* and 10*e*.

‡ Engineering 4*a*, 4*c* and 4*d* are preferably taken at the close of the First Year, but may be taken during any summer before October of the Fourth Year.

SECOND YEAR.

Differential and Integral Calculus (Engineering 1*c*).
Tu., Wed., Th., Sat., at 11, first half-year, and Tu., Th., Sat., at 11, second half-year. (XII)

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, *six to nine hours a week:* I, *Mon., Fri., 1.30–4.30;* II, *Tu., Th., 1.30–4.30. First half-year.* (IV)

Mechanism (Engineering 3*d*).
Mon., Fri., at 11; draughting, *four hours a week:* I, *Mon., Fri., 2.30-4.30;* II, *Tu., Th., 1.30–3.30. Second half-year.* (IV)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 9–11. First half-year. (XII)

Resistance of Materials (Engineering 5*d*).
Tu., Th., Sat., 9–11. Second half-year. (XII)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th., afternoons.* (VI)

Or, General Descriptive Physics (Physics 1).
Tu., Sat., at 12; and laboratory work, (*two hours a week, Tu., Wed., Th.*, or *Fri.*). (XIII)

English Composition (English *BC*).
Wed. at 1.30, and a second hour at the pleasure of the instructors. (VI)

THIRD YEAR.

Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (IV)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Engineering Laboratory (Engineering 13*a*).
Th., Sat., at 10; laboratory work, *three hours a week.* (XI)

Machinery and Boilers (Engineering 11*a*).*
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Thermodynamics (Engineering 12*b*).
Mon., Wed., Fri., at 9. First half-year. (II)

* Omitted from Third Year work after 1900–01.

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Industrial Applications of Electricity (Engineering 16*a*).
Tu., Th., Sat., at 9; laboratory work, *four hours a week. First half-year.* (X)

Electrical Transmission and Distribution of Power (Engineering 17*a*).
Tu., Th., Sat., at 9; laboratory work and visits, *two afternoons a week. Second half-year.* (X)

Machine Design (Engineering 14*a*).
Tu., at 11; draughting, *Tu., Th., 1.30–4.30. First half-year.* (XII)

FOURTH YEAR.

Resistance of Materials (Engineering 5*c*).
Mon., Fri., at 9, and a third hour at the pleasure of the instructor. First half-year. (II)

Water Supply and Sanitary Engineering (Engineering 6*c*).
Mon., Wed., Fri., at 10. First half-year. (III)

Canals, Rivers, and Irrigation (Engineering 6*d*).
Tu., Th., Sat., at 10; laboratory work, *six hours a week. Second half-year.* (XI)

Bridges and Buildings (Engineering 7*a*).
Mon., Wed., Fri., 1.30–4.30. (VI)

Masonry and Foundations (Engineering 8*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Industrial Applications of Electricity (Engineering 16*a*).†
Tu., Th., Sat., at 9; laboratory work *four hours per week. First half-year.* (X)

Electrical Transmission and Distribution of Power. (Engineering 17*a*).†
Tu., Th., Sat., at 9; laboratory work and visits, *two afternoons per week. Second half-year.* (X)

Elementary Geology (Geology 4).
Wed., Fri.; and occasionally Mon., at 12. Half-course. (V)

Elementary Field and Laboratory Geology (Geology 5).
In February and March: laboratory work (*two hours, twice a week*) in sections: Section A, *Tu., Th., 10–12;* or B, *Tu., Th., 1.30–3.30;* or C, *Wed., Fri., 1.30–3.30. In April and May:* field-work, *Th., or Fri.* (*one half-day a week*), and laboratory or field-work, *Tu., or Wed.* (V)

† Omitted from Fourth Year work after 1900–01.

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (XIII)

Engineering Conference (Engineering 21).
Two hours a week.

MECHANICAL ENGINEERING *

The degree of Bachelor of Science in Mechanical Engineering will be conferred on students who complete this programme and pass the required examinations satisfactorily.†

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Tu., Th., at 10, and an additional hour for conference. Second half-year.*
Or II, *Mon., Wed., at 11, and an additional hour for conference. First half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

Descriptive Inorganic Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German or French. One full course in addition to the admission requirements, so chosen as not to conflict with other prescribed courses.

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* For those only who did not present Physics for admission. (I and V)

* See also Regulations page 98.

† Students of Mechanical Engineering are advised to take in addition to this programme at least Course 4*a* of the Surveying Courses, Engineering 4*a*, 4*c* and 4*d*.

Shopwork. Chipping, Filing and Fitting (Engineering 10*a*).*
Ninety hours in summer.

Shopwork. Blacksmithing (Engineering 10*b*).*
Ninety hours in summer.

Shopwork. Pattern Making and Foundry Practice (Engineering 10*c*).*
Ninety hours in summer.

Shopwork. Machine-Shop Practice (Engineering 10*e*).*
Ninety hours in summer.

Second Year.

Differential and Integral Calculus (Engineering 1*c*).
Tu., Wed., Th., Sat., at 11, first half-year, and Tu., Th., Sat., at 11, second half-year. (XII)

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, *six to nine hours a week:* I, *Mon., Fri., 1.30–4.30;* II, *Tu., Th., 1.30–4.30. First half-year.* (IV)

Mechanism (Engineering 3*d*).
Mon., Fri., at 11; draughting, *four hours a week:* I, *Mon., Fri., 2.30–4.30;* II, *Tu., Th., 1.30–3.30. Second half-year.* (IV)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 9–11. First half-year. (XII)

Resistance of Materials (Engineering 5*d*).
Tu., Th., Sat., 9–11. Second half-year. (XII)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th., afternoons.* (VI)

Or, General Descriptive Physics (Physics 1).
Tu., Sat., at 12; and laboratory work, (*two hours a week, Tu., Wed., Th,, or Fri.*). (XIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

* Engineering 10*a*, 10*b*, 10*c* and 10*e* are preferably taken at the close of the First Year, but may be taken during any summer before October of the Fourth Year.

THIRD YEAR.

Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (IV)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Engineering Laboratory (Engineering 13*a*).
Th., Sat., at 10; laboratory work, *three hours a week.* (XI)

Machinery and Boilers (Engineering 11*a*).*
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Thermodynamics (Engineering 12*b*).
Mon., Wed., Fri., at 9. First half-year. (II)

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Industrial Applications of Electricity (Engineering 16*a*).
Tu., Th., Sat., at 9; laboratory work, *four hours a week. First half-year.* (X)

Electrical Transmission and Distribution of Power (Engineering 17*a*).
Tu., Th., Sat., at 9; laboratory work and visits, *two afternoons a week. Second half-year.* (X)

Machine Design (Engineering 14*a*).
Tu., at 11; draughting, *Tu., Th., 1.30–4.30. First half-year.* (XII)

FOURTH YEAR.

Resistance of Materials (Engineering 5*c*).
Mon., Fri., at 9, and a third hour at the pleasure of the instructor. First half-year. (II)

Engineering Laboratory (Engineering 13*b*).
Lecture, *once a week;* laboratory, *nine hours a week.*

Machine Design (Engineering 14*b*).
Twelve hours a week, Mon. and Fri.

Industrial Applications of Electricity (Engineering 16*a*).†
Tu., Th., Sat., at 9; laboratory work, *four hours a week. First half-year.* (X)

Electrical Transmission and Distribution of Power (Engineering 17*a*).†
Tu., Th., Sat., at 9; laboratory work and visits, *two afternoons a week. Second half-year.* (X)

* Omitted from Third Year work after 1900–01.
† Omitted from Fourth Year work after 1900–01.

Efficiency of Heat Engines (Engineering 12*a*).
Tu., Th., Sat., at 11. First half-year. (XII)

Heating and Ventilation (Engineering 12*c*).
Tu., Th., Sat., at 10. Second half-year. (XI)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (XIII)

Engineering Conference (Engineering 21).
Two hours a week.

ELECTRICAL ENGINEERING*

The degree of Bachelor of Science in Electrical Engineering will be conferred on students who complete this programme and pass the required examinations satisfactorily.†

First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Tu., Th., at 10, and an additonal hour for conference. Second half-year.*
Or, II, *Mon., Wed., at 11, and an additional hour for conference. First half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

Descriptive Inorganic Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German or French. One full course in addition to the admission requirements, so chosen as not to conflict with other prescribed courses.

* See also Regulations, p. 98.

† Students of Electrical Engineering are advised to take in addition to this programme at least Course 4*a* of the Surveying courses, Engineering 4*a*, 4*c*, and 4*d*.

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* For those only who did not present Physics for admission. (I and V)

Shopwork. Chipping, Filing and Fitting (Engineering 10*a*).*
Ninety hours in summer.

Shopwork. Blacksmithing (Engineering 10*b*).*
Ninety hours in summer.

Shopwork. Pattern Making and Foundry Practice (Engineering 10*c*).*
Ninety hours in summer.

Shopwork. Machine Shop Practice (Engineering 10*e*).*
Ninety hours in summer.

Second Year.

Differential and Integral Calculus (Engineering 1*c*).
Tu., Wed., Th., Sat., at 11, first half-year, and Tu., Th., Sat., at 11, second half-year. (XII)

Descriptive Geometry (Engineering 3*b*).
Mon., Fri., at 11; draughting, *six to nine hours a week:* I, *Mon., Fri., 1.30–4.30;* II, *Tu., Th., 1.30–4.30. First half-year.* (IV)

Mechanism (Engineering 3*d*).
Mon., Fri., at 11; draughting, *four hours a week:* I, *Mon., Fri., 2.30–4.30;* II, *Tu., Th., 1.30–3 30. Second half-year.* (IV)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 9–11. First half-year. (XII)

Resistance of Materials (Engineering 5*d*).
Tu., Th., Sat., 9–11. Second half-year. (XII)

Machinery and Boilers (Engineering 11*a*).
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th., afternoons.* (VI)

Or, General Descriptive Physics (Physics 1).
Tu., Sat., at 12; and laboratory work, (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

* Engineering 10*a*, 10*b*, 10*c* and 10*e* are preferably taken at the close of the First Year, but may be taken during any summer before October of the Fourth Year.

Third Year.

Applied Mechanics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (IV)

Hydraulics (Engineering 6*a*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Engineering Laboratory (Engineering 13*a*).
Th., Sat., at 10; laboratory work, *three hours a week.* (XI)

Machinery and Boilers (Engineering 11*a*).*
Mon., Wed., Fri., at 9, and Wed. afternoon. Second half-year. (II)

Thermodynamics (Engineering 12*b*).
Mon., Wed., Fri., at 9. First half-year. (II)

Metallurgy (Engineering 18*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Industrial Applications of Electricity (Engineering 16*a*).
Tu., Th., Sat., at 9; laboratory work, *four hours a week. First half-year.* (X)

Electrical Transmission and Distribution of Power (Engineering 17*a*).
Tu., Th., Sat., at 9; laboratory work and visits, *two afternoons a week. Second half-year.* (X)

Machine Design (Engineering 14*a*).
Tu., at 11; draughting, *Tu., Th., 1.30–4.30. First half-year.* (XII)

Fourth Year.

Resistance of Materials (Engineering 5*c*).†
Mon., Fri., at 9, and a third hour at the pleasure of the instructor. First half-year. (II)

Alternating Currents and Alternating Current Machinery (Engineering 16*e*).
Tu., Th., Sat., at 11. Laboratory work, *eight hours a week.* (XII)

Dynamo Design (Engineering 16*d*).
Tu., Th., 1.30–5 during first half-year and Tu., 1.30–5 during second half-year. (XIV)

Electrical Engineering Laboratory (Engineering 16*f*).
One afternoon a week. Half-course.

* Omitted from Third Year work after 1900–01.
† Omitted from the Fourth Year requirement after 1900–01.

Electrical Measurements (Physics 3).
Tu., at 12. Laboratory work, *six to eight hours a week.* (XIII)

Electrodynamics, Magnetism and Electromagnetism (Physics 4).
Tu., Th., at 10, and laboratory work. *First half-year.* (XI)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (XIII)

Engineering Conference (Engineering 21).
Two hours a week.

MINING AND METALLURGY.

General Statement.

The programme in Mining and Metallurgy is intended to provide a thorough preparation for professional work in those subjects. While the courses scheduled below may be completed in four years, it is believed that all students will find it to their advantage to devote five years to their professional training, and those who do not anticipate some of the required work for admission are advised to give this extra time.

The required work of the first year is identical with that of the four year programmes in Engineering, General Science and Geology, except that Spanish may be substituted for advanced French or German. The work of the second year does not differ materially from that in the programmes in Engineering, except in the requirements of Chemistry and Geology. Thus the student is not bound to choose his programme of study until after his first year of residence, and a change may be made even at the end of his second year, after more mature reflection and experience, without serious inconvenience.

Specialization in Mining and Metallurgy begins in the third year with introductory courses in Mining, Fire Assaying, and Metallurgical Chemistry for which the work of the preceding years has paved the way. The remaining time of the student is largely devoted to the allied subjects of Mineralogy and the Geology of Ore-deposits.

In the fourth year half the work is required and half is elective subject to the approval of the department. This arrangement is intended to permit some specialization either in Mining or Metallurgy. Thus if the student looks towards Metallurgy his elections will include Metallography and the advanced course in Metallurgical Chemistry, while if he desires to specialize in Mining they will include Mining 11 and courses in Economic and Field Geology.

Students in Harvard College who intend to take this programme are advised to anticipate as far as possible the work of the first two years.

The corresponding courses in the Department of Mathematics are accepted as the equivalent of the Mathematical work of the first and second year. The attention of such students is called to the regulations under which the degrees of A.B. and S.B. may be obtained in five years, page 80.

Equipment.

The Rotch building on Holmes field has been set apart by the Corporation for the use of the Department of Mining and Metallurgy. The building contains a lecture room, a library, a reading and exhibition room, and laboratories for Metallurgical Chemistry, Assaying, Ore-dressing, and Metallurgy.

The Laboratory for Metallurgical Chemistry, situated in the west wing of the Rotch building, contains the necessary apparatus for the analysis of ores and furnace products.

The Assay Laboratory contains muffle and wind furnaces with all the necessary apparatus for sampling and assaying ores.

The Ore-dressing Laboratory is situated in the East wing of the Rotch building, and contains apparatus for the concentration and stamp milling of gold and silver ores.

The equipment includes crusher, rolls, elevators, screens, jigs, hydraulic sizers, shaking tables, slime belt, buddle, amalgamating pans, settler, and a five stamp battery with all the necessary additions for the complete treatment of low grade, free milling, and concentrating ores.

Facilities are also provided for mechanical and hand sampling of all ores previous to treatment.

The machines are so arranged that they may be operated independently or in any desired combination for experimental work.

Summer Work.

In the summer vacation following the first year the student is advised to take Geology S1 thereby anticipating Geology 4 and 5 of the second year, but is not required to do so.

In the summer vacation following the second year the courses in Surveying, lasting nine weeks, are required.

In the summer vacation following the third year Mining 12, lasting six weeks, is required.

The degree of Bachelor of Science in Mining and Metallurgy will be conferred on students who complete the programme and pass the required examinations satisfactorily.

FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Mon., Wed., at 11, and an additional hour for conference. First half-year. Or* II, *Tu., Th., at 10, and an additional hour for conference. Second half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30;* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

†Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (I and V)

Descriptive Inorganic Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–4.30; or Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

One full course in a Modern Language.

Geology 4 and 5 in the second year may be anticipated in the summer vacation of the first year by taking Geology S 1.

SECOND YEAR.

Differential and Integral Calculus (Engineering 1*c*).
Tu., Wed., Th., Sat., at 11, first half-year, and Tu., Th., Sat., at 11, second half-year. (XII)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 9–11. First half-year. (XII)

Resistance of Materials (Engineering 5*d*).
Tu., Th., Sat., 9–11. Second half-year. (XII)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

† For those who have not offered Physics for admission.

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 12; laboratory work, (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11. (IV)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. Half-course. (V)

Elementary Field and Laboratory Geology (Geology 5).
In February and March: laboratory work (*two hours, twice a week*), in sections: Section A, *Tu., Th., 10–12;* or B, *Tu., Th., 1.30–3.30;* or C, *Wed., Fri., 1.30–3.30. In April and May:* field-work, *Th. or Fri.* (*one half-day a week*), and laboratory or field-work, *Tu. or Wed. Second half-year.* (V)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

Summer work: Surveying, *9 weeks.*

Third Year.

Prospecting and Exploring (Mining 1).
Tu., Th., Sat., at 12. Second half-year. (XIII)

Metallurgical Chemistry (Metallurgy 6).
Mon., Wed., Fri., at 2.30. First half-year. (VII)

Mineralogy (Mineralogy 2).
Mon., Wed., Fri., at 10, with additional laboratory hours. (III)

Fire Assaying (Mining 10).
Tu., Th., Sat., at 11. First half-year. (XII)

Mining Geology (Geology 10).
Tu., Th., Sat., at 10. (XI)

Applied Mechanics, including Elementary Kinetics (Engineering 5*a*).
Mon., Wed., Fri., at 11. (IV)

Industrial application of Electricity (Engineering 16*a*).
Tu , Th., Sat., at 9; laboratory work, *four hours a week. First half-year.* (X)

The Study of Mining Operations (Mining 12).
Six weeks in the summer.

Fourth Year.

Ore Dressing (Mining 4).
Mon., Wed., Fri., at 9. (II)

Metal and Coal Mining (Mining 5).
Mon., Wed., Fri., at 10. (III)

Metallurgy of iron and steel (Metallurgy 2).
Mon., Wed., Fri., at 12. First half-year. (V)

Metallurgy of copper, nickel, lead, zinc, and the minor metals (Metallurgy 3).
Mon., Wed., Fri., at 12. Second half-year. (V)

And two and a half elective courses to be approved by the Department.

ARCHITECTURE.

The following schedule sets forth the studies required of those persons who are candidates for the degree of S.B. in Architecture. By anticipating any of these subjects at the admission examination or by passing in the equivalent course in the Summer School, students gain additional time to devote to the strictly professional studies. The programme is arranged to be completed in four years, but students should take five years unless they have anticipated at least two of the following subjects :— Prescribed English, Advanced French, Advanced German, Elementary Physics.

Candidates for admission who intend to pursue this programme are therefore advised to offer the above-named subjects in the examination for admission, as well as Freehand Drawing and the History of Greece and Rome. It will be found advantageous to have a thorough preparation in both French and German before entering. A pamphlet may be had on application giving a more detailed account of the work and facilities of the Department of Architecture.

The instruction offered in this programme is intended to afford the preliminary technical training required for the practice of Architecture. As all such school training must be supplemented by practical experience in an architect's office, students are advised during their period of study to devote a portion of their summer vacation to that work. The programme is so arranged that professional studies begin in the First-Year and are continued through four years. In the First-Year the History of Ancient Architecture is taken up in such a way as to give the student a familiarity with classic form which shall serve as a basis for the subsequent practice in original Design which continues through the whole of the following

three years. The History of Architecture (with practice in drawing its various forms) is continued through the Second-Year and completed in the Third.

The study of Design is pursued mainly by means of problems and criticisms. In addition to the regular staff of instructors, the Committee appointed by the Board of Overseers takes part in the instruction in design, in the advanced work of the Third-Year. Each member of the Committee in turn has charge of a problem, discussing with the class the conditions when it is given out and a week later criticising the preliminary sketches. The final drawings having been made by the students under the direction of the regular instructors, the final criticism is given by the visiting member of the Committee. This method of work has proved especially valuable and stimulating. This Committee now consists of Messrs. R. S. Peabody, E. M. Wheelwright, A. Wadsworth Longfellow, Jr., and R. Clipston Sturgis.

With regard to Construction, a thorough and broad general knowledge of principles and their application to modern work will be insisted upon rather than a minute consideration of constructive details. So much of Mathematics is taught as is necessary to this knowledge and to the exigencies of actual office practice. The mathematics required is completed in the First-Year. In the Second-Year Mechanics and Strength of Materials is taken up, and Building Construction in the Third.

Facilities will be given for graduate work in Architecture, and students who can do so are advised to extend their period of school training by one or more years of graduate study. The four years that have been allotted usually, in this country, to such training is a much shorter time than is given in the great schools of art in Europe, or than might with advantage be devoted to academic training in architecture.

The courses in Architecture have been arranged primarily to meet the needs of students in the Scientific School who are taking the technical four years' programme. All of these courses are open also to students in the College who are fitted to profit by them, and the courses on the History of Architecture (1*a*, 1*b*, 1*c*) may be counted towards the degree of A.B.

Students in the College intending, after graduation, to take up the study of Architecture professionally, are advised to arrange their College course in such a way as to provide a foundation for their professional studies. Besides taking the courses in Fine Arts, such students are recommended to study the History of Greece and Rome, the Middle Ages, and the Renaissance. They may also, with advantage, take such courses in Classical Philology as have a bearing on the History of Art, and it is important that they should acquire a knowledge of French and German, as the best works on architecture are in these languages. The mathe-

matics required in the four years' programme in architecture may with great advantage be anticipated. The Professor of Architecture will be glad to advise with students who intend to plan such a course.

If the College course is carefully planned with that end in view, it will be possible to graduate in Architecture in two years after taking the degree of Bachelor of Arts, if some of the professional studies have been anticipated.

The work of the architect requires not only a technical knowledge of building processes and familiarity with architectural form, its history and use, but it demands wide intellectual sympathy, cultivated taste, and trained imagination. Such training and cultivation can most readily be obtained — or the impulse leading to it can best be given — by a carefully arranged college course. Those who intend to pursue architecture as a profession are therefore strongly advised to take, if possible, a full college course before beginning their technical studies.

The President and Fellows of Harvard College have established from the bequest of the late Edward Austin, the Austin Travelling Fellowship in Architecture, of the annual value of $1000, to be held for one year, and to be awarded annually until further notice.

The fellowship is open for competition to those who of their own means are not able to bear the expense of so extended a period of study abroad.

Candidates must be Bachelors of Science in Architecture of Harvard University, of not more than three years' standing at the Commencement next preceding the examination for the Fellowship, and must have taken the degree with distinction.

The selection among those admitted to candidacy will be made on the results of a competitive examination in the history of architecture and in design, to be held in Cambridge in the month of October of each year.

Applications of candidates must be sent to the Secretary of the Lawrence Scientific School before the first day of September of the year in which they expect to present themselves for examination.

The degree of S.B. in Architecture will be conferred on students who complete this programme, pass the required examinations satisfactorily, and present an acceptable thesis.

First Year.

Technical and Historical Development of the Ancient Styles (Architecture 1*a*).
Mon., Wed., Fri., at 12, and additional hours for drawing. (V)

Elementary Architectural Drawing. — The Orders (Architecture 2*a*).
At least 14 hours a week. (XV)

Principles of Delineation, Color, and Chiaroscuro (Fine Arts 1).
Mon., Wed., Fri., at 2.30, and additional hours for drawing. (VII)

Trigonometry (Engineering 1*b*).
Mon., Wed., at 11, and an additional hour for conference. First half-year. (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Rhetoric and English Composition (English *A*).
Divided in sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German *or* French.¶
One full course.

*Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (I and V)

Second Year.

Freehand Drawing from Architectural Subjects (Architecture 3*a*).
Two sections. I, *Mon., Wed., Fri., at 9, and three other hours;* II, *Tu., Th., Sat., at 9, and three other hours.* (II)

†Technical and Historical Development of the Mediaeval Styles (Architecture 1*b*).
Mon., Wed., Fri., at 10. (III)

Or †Technical and Historical Development of the Renaissance and Modern Architecture (Architecture 1*c*).
Mon., Wed., Fri., at 10. (III)

Elementary Architectural Design (Architecture 4*a*).
At least fourteen hours a week. (XV)

Elementary Statics (Engineering 5*b*).
Tu., Th., Sat., 9–11. First half-year. (XII)

Resistance of Materials (Engineering 5*d*).
Tu., Th., Sat., 9–11. Second half-year. (XII)

Descriptive Geometry. — Elementary Shades, Shadows, and Perspective (Engineering 3*b*).
Lectures, *Mon., Fri., at 11;* draughting, *six to nine hours a week:* I, *Mon., Fri., 1.30–4.30:* II, *Tu., Th., 1.30–4.30. First half-year.* (IV)

¶ Students who have passed both Advanced French and Advanced German in the admission examinations are exempted from further study of these languages.

* For those who do not present Physics for admission.

† These courses are given in alternate years.

Stereotomy, Shades, Shadows, and Perspective (Engineering 3*e*).
Lectures, *Wed., at 11;* draughting, *six hours a week: Tu., Th., 1.30–4.30. Second half-year.* (IV)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

German *or* French.¶
One full course.

THIRD YEAR.

Freehand Drawing from Architectural Subjects (Architecture 3*b*).
Two sections: I, *Mon., Wed., Fri., at 9, and three other hours;* II, *Tu., Th., Sat., at 9, and three other hours.* (II)

†Technical and Historical Development of the Mediaeval Styles (Architecture 1*b*).
Mon., Wed., Fri., at 10. (III)

Or †Technical and Historical Development of the Renaissance and Modern Architecture (Architecture 1*c*).
Mon., Wed., Fri., at 10. (III)

Architectural Design (second course) (Architecture 4*b*).
At least eighteen hours a week. (XV)

Theory of Design (Architecture 7).
Mon., Wed., 1.30–3.30. First half-year.

Building Construction. — Carpentry. Lectures and drawing (Architecture 5).
Tu., 2.30–4.30. Second half-year. (XVI)

Masonry and Foundations (Engineering 8*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Building Stones (Mineralogy 3).
Wed., at 1.30. First half-year. (VI)

And one the following courses: —

*Principles of Design in Painting, Sculpture, and Architecture (Fine Arts 2).
Mon., Wed., Fri., at 3.30. (VIII)

Or History of Greek Art (Fine Arts 3).
Tu., Th., Sat., at 9. (X)

Or *The Fine Arts of the Middle Ages and of the Renaissance (Fine Arts 4).
Mon., Wed., Fri., at 9. (II)

¶ See note on previous page.
† These courses are given in alternate years.
* Fine Arts 2 and Fine Arts 4 cannot both be counted towards a degree by the same student.

Or *The Life of the Ancient Athenians (Greek 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (XIII)

Or *The Private Life of the Romans (Latin 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (XIII)

FOURTH YEAR.

Freehand Drawing from Architectural Subjects (Architecture 3*c*).
Two sections: I, *Mon., Wed., at 9, and four other hours;* II, *Tu., Th., at 9, and four other hours.* (II)

Architectural Design (advanced course) (Architecture 4*c*). (XV)

Modelling (Architecture 6).
Fri., 1.30–4.30. (VIII)

Contracts and Specifications (Engineering 22).
Sat., at 12. Second half-year. (XIII)

And the equivalent of two courses not already taken, selected from the following: —

†Principles of Design in Painting, Sculpture, and Architecture (Fine Arts 2).
Mon., Wed., Fri., at 3.30. (VIII)

History of Greek Art (Fine Arts 3).
Tu., Th., Sat., at 9. (X)

†The Fine Arts of the Middle Ages and of the Renaissance (Fine Arts 4).
Mon., Wed., Fri., at 9. (II)

Classical Archaeology (Fine Arts 20).
Mon., 9–10.30 (either half of this may be taken as a half-course). (II)

*The Private Life of the Romans (Latin 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (XIII)

*The Life of the Ancient Athenians (Greek 10).
Tu., Th., and (at the pleasure of the instructor) Sat., at 12. (XIII)

Aesthetics (Philosophy 10).
Mon., Wed., Fri., at 2.30. Second half-year. (VII)

Water Supply and Sanitary Engineering (Engineering 6*c*).
Mon., Wed., Fri., at 10. First half-year. (III)

Heating and Ventilation (Engineering 12*c*).
Tu., Th., Sat., at 10. Second half-year. (XI)

* These courses are given in alternate years.

† Fine Arts 2 and Fine Arts 4 cannot both be counted towards a degree by the same student.

LANDSCAPE ARCHITECTURE.

The object of the programme of study outlined below is to provide the instruction in the elements of technical knowledge and the training in the principles of design which together form the proper basis for the professional practice of Landscape Architecture.

Instruction in the Theory of Design will begin in the first year with the historical and technical courses, Fine Arts 1 and Architecture 1*a*, followed by a special course in the second year on the History and Principles of Landscape Design, consisting of lectures supplemented by collateral reading, conferences and exercises in drawing illustrative of the lectures. This special course will be supplemented by a general course on the Principles of Design in the Fine Arts (Fine Arts 2) and by a course in Elementary Architectural Design (Architecture 4*a*). The latter, which is a second year course for students of architecture, will be modified to meet the needs of the Landscape students, and stress will be laid upon planning the general arrangement of buildings, upon the treatment of axial arrangements and symmetry in design, and upon the grouping of masses, rather than upon architectural detail. During the third and fourth years, there will be given successive courses in Landscape Design, including occasional lectures, but consisting chiefly of the actual solution of problems of design by the students under the guidance and criticism of the instructors.

As a prerequisite to intelligent and successful design the students will be given a working knowledge of the materials which are required in the execution of plans, and a familiarity with the means by which they are utilized. In this connection particular attention will be given to the study of plants both as individuals and as elements of landscape. In the first year will be given lectures and laboratory work in Botany, supplemented by study of plants and garden-work at the Botanic Garden. The second year includes a course in Horticulture at the Bussey Institution, consisting of lectures, with study and practice in the greenhouses and in the field and garden. In the third and fourth years there will be given successive courses on Plants in Relation to Landscape Planting, conducted mainly at the Bussey Institution and the Arnold Arboretum. These courses will be carefully related to the courses in Design and will be supplemented by special summer work after the third year.

All the other technical instruction, which is closely similar to that required for Engineers and Architects, will be given at Cambridge, with the exception of the summer field course in Surveying, which is conducted at a distance from the University. This course will ensure the necessary familiarity with the making and interpreting of topographical

maps. For the general training of the eye and hand, and as a necessary preliminary and accompaniment to the courses in Design, much attention will be given to both mechanical and free-hand drawing. The engineering requirements of the profession will be fulfilled in the courses in Trigonometry, Topographical Surveying, Construction and Maintainance of Common Roads, Water Supply and Drainage, Masonry and Foundations, and Contracts and Specifications. The courses in Landscape Design will further include the elaboration of construction plans. The courses in Elementary Architectural Design, and in the Technical and Historical Development of the Ancient, Renaissance, and Modern Styles, will give a valuable training in the principles of design and some knowledge of the treatment of the minor problems of an architectural nature arising in connection with most landscape work and especially in connection with formal gardens and terraces. It will also give a sufficient knowledge of architectural methods to prepare for intelligent conference with architects in regard to the problems in which the two professions overlap.

The four courses in Geology and Geography are included in the programme in order to give a useful, practical understanding of geological structure and weather conditions, and to open the way to a better comprehension of landscape forms and a more intelligent sympathy in dealing with them.

With the best of technical training, the professional success of a Landscape Architect must depend largely upon his ability to enter into touch with the wide range of ideals which he is sure to find among his clients. In no way can this ability be fostered more effectively than by the broadening influence of a college education, and while the following programme represents a four years' course open to students who can pass the entrance examinations of the School, it is expected that a large proportion of them will have taken a full college course before devoting themselves to strictly professional work. The college student who arranges his programme with that end in view can take with his other work a sufficient number of semi-technical studies to fit himself for completing the programme in Landscape Architecture in three or even in two years after receiving the A.B. degree. The instruction in the purely professional courses is therefore addressed primarily to those approaching the subject from the point of view of graduate students.

The examinations for admission are the same as those required for the other departments of the Lawrence Scientific School. Candidates for admission intending to pursue the Landscape Course are strongly urged to offer Botany, Free-hand Drawing, Projections, Elementary and Advanced Physics, and both French and German.

The degree of Bachelor of Science in Landscape Architecture will be conferred on students who complete the following programme, pass the examinations satisfactorily, and present an acceptable thesis.

First Year.

Principles of Delineation (Fine Arts 1).
Mon., Wed., Fri., at 2.30, and additional hours for drawing. (VII)

Technical and Historical Development of the Ancient Styles of Architecture (Architecture 1*a*).
Mon., Wed., Fri., at 12, and additional hours for drawing. (V)

Elementary Architectural and Landscape Drawing (Architecture 2*a*).
At least fourteen hours a week. (XV)

Trigonometry (Engineering 1*b*).
Mon., Wed., at 11, and an additional hour for conference. First half-year. (XI)

Elementary Botany (Botany 1).
Tu., Th., at 10; laboratory work, *four hours a week. Second half-year.* (XI)

Rhetoric and English Composition (English *A*).
Divided in sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11,* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German *or* French.
One full course.

Second Year.

History and Principles of Landscape Design (Landscape Design 1).
Mon., Wed., Fri., at 12. (V)

Principles of Design in Painting, Sculpture, and Architecture (Fine Arts 2).
Mon., Wed., Fri., at 3.30. (VIII)

Elementary Architectural Design (Architecture 4*a*).
At least fourteen hours a week. (XV)

†Technical and Historical Development of the Renaissance and Modern Styles of Architecture (Architecture 1*c*).
Mon., Wed., Fri., at 10. (III)

Or Elementary Physiography (Geology *A*).
Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory hours. First half-year. (IV)

† This course is given in alternate years.

And Meteorology (Geology *B*).
Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu., between 9 and 1, and additional laboratory hours. Second half-year. (IV)

Horticulture (Horticulture 1*a* and 1*b*). *At the Bussey Institution.*
Tu., Th., Sat., mornings.

Land Surveying (Engineering 4*a*).
Field practice. *Four weeks*, beginning as early as possible in June.

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

Optional.

Agricultural Chemistry. *At the Bussey Institution.*
Mon., Fri., 9.30–10.30.

THIRD YEAR.

Practice in Landscape Design (*first course*) (Landscape Design 2).
Mon., Wed., Fri., at 11, and twelve additional hours. (IV)

Freehand Drawing (Architecture 3*a*).
Two sections. I, *Mon., Wed., Fri., at 9, and three other hours;* II, *Tu., Th., Sat., at 9, and three other hours.* (II)

Physiography (Geology *A*).
Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory hours. First half-year. (IV)

And Meteorology (Geology *B*).
Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 1, and additional laboratory hours. Second half-year. (IV)

Or †Technical and Historical Development of the Renaissance and Modern Styles of Architecture (Architecture 1*c*).
Mon., Wed., Fri., at 10. (III)

Study of Plants in relation to Landscape Planting (*first course*) (Horticulture 2). *At the Bussey Institution.*
Tu., Th., 2 to 4.30.

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. Half-course. (V)

† This course is given in alternate years.

Elementary Field and Laboratory Geology (Geology 5).
In February and March: laboratory work (*two hours, twice a week*) in sections: Section A, *Tu., Th., 10–12;* or B, *Tu., Th., 1.30–3.30;* or C, *Wed., Fri., 1.30–3.30. In April and May:* field-work, *Th. or Fri.* (*one half-day a week*), and laboratory or field-work, *Tu. or Wed. Second half-year.* (V)

Common Roads (Engineering 4*e*).
Tu., Th., Sat., at 9. Second half-year. (X)

Summer work in the Study of Plants.

Fourth Year.

Practice in Landscape Design (*second course*) (Landscape Design 3).
Mon., Wed., Fri., 10–12, and twelve additional hours. (III and IV)

Study of Plants in relation to Landscape Planting (*second course*) (Horticulture 3). *At the Bussey Institution.*
Tu., Th., afternoons.

Freehand Drawing (Architecture 3*b*).
Two sections: I, *Mon., Wed., Fri., at 9, and three other hours;* II, *Tu., Th., Sat., at 9, and three other hours.* (II)

Water Supply and Sanitary Engineering (Engineering 6*c*).
Mon., Wed., Fri., at 10. First half-year. (III)

Masonry and Foundations (Engineering 8*a*).
Tu., Th., Sat., at 11. Second half-year. (XII)

Contracts and Specifiations (Engineering 22).
Sat., at 12. Second half-year. (XIII)

Thesis.

CHEMISTRY.

This programme of study is intended for students preparing to become practical chemists or teachers of the science.

The degree of Bachelor of Science in Chemistry will be conferred on students who complete this programme, pass the required examinations, and present a satisfactory thesis.

First Year.

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Mon., Wed., at 11, with an additional hour for conference. First half-year. Or* II, *Tu., Th., and an additional hour for conference. Second half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).
I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German *or* French.
One full course.

Second Year.

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11. (IV)

Quantitative Analysis (Chemistry 4)
Mon., Wed., Fri., at 3.30. (VIII)

Mineralogy (Mineralogy 2).
Mon., Wed., Fri., at 10, and additional laboratory hours. (III)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 12; laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

German *or* French.
One full course.

Third Year.

Advanced Quantitative Analysis (Chemistry 9).
Mon., Wed., Fri., at 2.30. First half-year. (VII)

Gas Analysis (Chemistry 10).
Mon., Wed., Fri., at 2.30. Second half-year. (VII)

The Carbon Compounds (Chemistry 5).
Mon., Wed., Fri., at 9. (II)

Chemical Philosophy (Chemistry 8).
Tu., Th., at 12. Second half-year. (XIII)

Elementary Botany (Botany 1).
Tu., Th., at 10, and laboratory work, *four hours a week. Second half-year.* (XI)

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and alternate Sats., at 10. Laboratory work (exercises may be taken in any one of the following sections): I, *Sat., 9–10 and 11–1;* II, *Mon., 9–12;* III, *Mon., 1.30–4.30;* IV, *Tu., 9–10 and 11–1;* V, *Tu., 1.30–4.30. First half-year.* (XI)

German *or* French.
One full course.

FOURTH YEAR.

Physical Chemistry (Chemistry 6).
Mon., Wed., Fri., at 12. (V)

Advanced study and research with preparation of a thesis (Chemistry 20), the equivalent of four courses.

GEOLOGY.

The studies in this programme are designed to furnish a special training for those who wish to prepare themselves for duty in Government Geological Surveys or for teaching. The studies may, on special application to the Administrative Board of the School, be varied to meet the wants of individual students beyond the limits indicated in the programme.

All students are required to take one of the advanced courses in Geology during one of their summer vacations. Students who design entering the School in the autumn of any year are advised to take the Summer Course in Elementary Geology, which is regarded as the equivalent of Geology 4 and 5.

The degree of S.B. in Geology is conferred on students who complete this programme and pass the required examinations satisfactorily.

FIRST YEAR.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).

I, *Mon., Wed., at 11, and an additional hour for conference. First half-year. Or* II, *Tu., Th., at 10, and an additional hour for conference. Second half-year.* (XI)

Analytic Geometry (Engineering 1*d*).

Mon., Wed., Fri., at 10. Second half-year. (III)

Mechanical Drawing (Engineering 3*a*).

I, *Mon., at 1.30;* draughting, *Mon., Fri., 1.30–4.30:* II, *Tu., at 1.30;* draughting, *Tu., Th., 1.30–4.30.* (VI)

General Descriptive Chemistry (Chemistry 1).

Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30,* or *Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

One full course in German or French.

Geology S 1 recommended.

Second Year.

Elementary Physiography (Geology *A*).

Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 12, and additional laboratory hours. First half-year. (IV)

†Elementary Geology (Geology 4).

Wed., Fri., and occasionally Mon., at 12. Half-course. (V)

†Elementary Field and Laboratory Geology (Geology 5).

In February and March: laboratory work (*two hours, twice a week*) in sections: Section A, *Tu., Th., 10–12;* or B, *Tu., Th., 1.30–3.30;* or C, *Wed., Fri., 1.30–3.30. In April and May:* field-work, *Th. or Fri* (*one half-day a week*), and laboratory or field-work, *Tu. or Wed. Second half-year.* (V)

Mineralogy (Mineralogy 2).

Mon., Wed., Fri., at 10; with additional laboratory hours. (III)

Experimental Physics (Physics *C*).

Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

† If not anticipated by Geology S1.

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 12; laboratory work (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

Elementary Zoölogy (Zoölogy 1).
Tu., Th., and alternate Sats., at 10; laboratory work may be taken in any one of the following sections: I, *Sat., 9–10 and 11–1;* II, *Mon., 9–12;* III, *Mon., 1.30–4.30;* IV, *Tu., 9–10 and 11–1;* V, *Tu., 1.30–4.30. First half-year.* (XI)

Elementary Botany (Botany 1).
Tu., Th., at 10; laboratory work, *four hours a week. Second half-year.* (XI)

Engineering 4*a*. Summer Work.

Third Year.

Physiography of the United States (Geology 6).
Mon., Wed., Fri., at 12. Second half-year. (V)

Or Physiography of Europe (Geology 7).
Mon., Wed., Fri., at 12. Second half-year. (V)

General Critical Geology (Geology 8).
Wed., Fri., and occasionally Mon., at 9, with additional hours for conference and field-work. (II)

Palaeontology (Geology 14).
Wed., Fri., and occasionally Mon., at 10. Half-course. (III)

General Palaeontology (Geology 14*a*).
Mon. at 10; laboratory work, *two hours twice a week. Half-course.* (III)

Petrography (Mineralogy 12).
Tu., Th., at 11, and an occasional third hour, with additional laboratory hours. (XII)

And either French 1*b* or German 1*c*, if not taken before.

Summer work (prescribed) Geology S 2.

Fourth Year.

Mining Geology (Geology 10).
Tu., Th., Sat., at 10. (XI)

Historical Geology (Geology 15).
Mon., at 3.30. (VIII)

Advanced Geological field-work (Geology 22).

Th., at 3.30, and a second hour at the pleasure of the instructor. (XVI)

And two additional courses approved by the Department of Geology.

BIOLOGY.

The degree of Bachelor of Science in Biology will be conferred on students who complete this course, pass the required examinations and present a satisfactory thesis.

First Year.

Elementary Zoölogy (Zoölogy 1).

Tu., Th., and alternate Sats., at 10; laboratory work may be taken in any one of the following sections: I, *Sat., 9–10 and 11–1;* II, *Mon., 9–12;* III, *Mon., 1.30–4.30;* IV, *Tu., 9–10 and 11–1;* V, *Tu., 1.30–4.30. First half-year.* (XI)

Elementary Botany (Botany 1).

Tu., Th., at 10; laboratory work, *four hours a week. Second half-year.* (XI)

Morphology of Animals (Zoölogy 2).

Mon., Wed., Fri., at 2.30. Laboratory work. *Second half-year.* (VII)

Morphology of Plants (Botany 2).

Mon., Wed., Fri., at 2.30. Laboratory work. *First half-year.* (VII)

*Experimental Physics (Physics *B*).

Wed., at 12; laboratory work, *two hours a week.* (I and V)

Physiography (Geology *A*).

Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu., between 9 and 12, and additional laboratory hours. First half-year. (IV)

Meteorology (Geology *B*).

Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 1, and additional laboratory hours. Second half-year. (IV)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German or French. One full course.

* Physics *B* may be omitted by those students who have passed in Experimental Physics for admission.

Second Year.

Physiology and Histology of Plants (Botany 3).
Tu., Th., at 2.30. Laboratory work. (XV)

Comparative Anatomy of Vertebrates (Zoölogy 3).
Tu., Th., Sat., at 9. Laboratory work. (X)

General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30;* or *Wed., Fri., 2.30–4.30.* (V)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 12; laboratory work, (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

German or French. One full course.

Third Year.

Four courses are required for the third year. Of these the following two and a half courses are prescribed: —

Cryptogamic Botany (Botany 4).
Tu., Th., Sat., at 11. Laboratory work. *Second half-year.* (XII)

Microscopical Anatomy (Zoölogy 4).
Mon., Wed., Fri., at 10. Laboratory work. *First half-year.* (III)

Elementary Geology (Geology 4).
Wed., Fri., and occasionally Mon., at 12. Half-course. (V)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11. Laboratory work. (IV)

The remaining course and a half must be elected from the following list, but students proposing to do their fourth year thesis work in Zoölogy must include in their election Zoölogy 5.

Embryology of Vertebrates (Zoölogy 5).
Mon., Wed., Fri., at 10. Laboratory work. *Second half-year.* (III)

Fossil Invertebrates (Zoölogy 9).
Tu., Th., and (at the pleasure of the instructor) Sat., at 10. Laboratory work. *First half-year.* (XI)

Experimental Morphology. — Ontogenesis studied as a process (Zoölogy 10).
Tu., Th., at 3.30. (XVI)

Or Experimental Morphology. — Phylogenesis (Zoölogy 11).
Tu., Th., at 3.30. (XVI)

These courses are given in alternate years.

Elementary Field and Laboratory Geology (Geology 5).
In February and March: laboratory work (*two hours, twice a week*) in sections: Section A, *Tu., Th., 10–12;* or B, *Tu., Th., 1.30–3.30;* or C, *Wed., Fri., 1.30–3.30. In April and May:* field-work, *Th.* or *Fri.* (*one half-day a week*), and laboratory or field work, *Tu.* or *Wed. Second half-year.* (V)

Advanced French (French 1*c*).
Mon., Wed., Fri., at 9. (II)

The Nervous System and its Terminal Organs. — Sense Organs (Zoölogy 15).
Mon., Wed., Fri., at 3.30. Second half-year. (VIII)

Or The Nervous System and its Terminal Organs. — Central Nervous Organs and Terminal Organs of Efferent Nerves (Zoölogy 16).
Mon., Wed., Fri., at 3.30. Second half-year. (VIII)
Courses 15 and 16 are given in alternate years.

[Systematic Botany (Botany 5).]
Omitted in 1900–01. (XVI)

The Carbon Compounds (Chemistry 5).
Mon., Wed., Fri., at 9. Laboratory work. (II)

General Introduction to Philosophy (Philosophy 1*a*).
Mon., Wed., Fri., at 2.30. (VII)

Fourth Year.

Four courses are required for the Fourth Year.

In this year the student must pursue some original investigation to the extent of at least two courses under the direction of one of the Instructors in the Departments of Botany or of Zoölogy. During the first week of the year he must arrange with his special Instructor the plan of study which he proposes. At the end of the year he must present a thesis, giving the results of his studies.

The courses in which research can be conducted are the following: —

Structure and Development of Phanerogams (Botany 20*a*).

Structure and Development of Cryptogams (Botany 20*b*).

Anatomy and Development of Vertebrates and invertebrates (Zoölogy 20*a*).

The remainder of the Fourth-Year is to be elected from the Third-Year elective list.

ANATOMY AND PHYSIOLOGY.

The aim of this programme is to afford a suitable preliminary training in science for students who intend to pursue the study of Medicine. Only those branches of science are prescribed which lead directly to medical study, together with a minimum course in English, German and French. The selection of elective courses must be approved by the adviser.

Students pursuing this course will be admitted to the Medical School at the end of the third year, and, after satisfactorily completing the prescribed course of the first year in the Medical School, will receive the degree of Bachelor of Science.

The degree of Bachelor of Science in Anatomy and Physiology will be conferred on students who complete this course of study and pass the required examinations satisfactorily.

First Year.

Elementary Zoölogy (Zoölogy 1).

Tu., Th., and alternate Sats., at 10; laboratory work may be taken in any one of the following sections: I, *Sat., 9–10 and 11–1;* II, *Mon., 9–12;* III, *Mon., 1.30–4.30;* IV, *Tu., 9–10 and 11–1;* V, *Tu., 1.30–4.30. First half-year.* (XI)

Elementary Botany (Botany 1).

Tu., Th., at 10; laboratory work, *four hours a week. Second half-year.* (XI)

†Experimental Physics (Physics *B*).

Wed., at 12; laboratory work, *two hours a week.* (I and IV)

General Descriptive Chemistry (Chemistry 1).

Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

German *or* French.

One full course.

And one full course of elective study.

† Physics *B* may be omitted by those students who have passed in Experimental Physics for admission.

Second Year.

Morphology of Animals (Zoölogy 2).
Mon., Wed., Fri., at 2.30. Laboratory work. *Second half-year.* (VII)

Morphology of Plants (Botany 2).
Mon., Wed., Fri., at 2.30. Laboratory work. *First half-year.* (VII)

Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.* Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th., afternoons.* (VI)

Or General Descriptive Physics (Physics 1).
Tu., Sat., at 12; laboratory work, (*two hours a week, Tu., Wed., Th.,* or *Fri.*). (XIII)

Qualitative Analysis (Chemistry 3).
Mon., Wed., Fri., at 11. Laboratory work. (IV)

English Composition (English *BC*).
Wed., at 1.30, and a second hour at the pleasure of the instructors. (VI)

And two full courses of elective study.

Third Year.

Elementary Physiology and Hygiene (Hygiene 1).
Tu., Th., Sat., at 10, laboratory work, *three hours a week,* in sections. (XI)

Comparative Anatomy of Vertebrates (Zoölogy 3).
Tu., Th., Sat., at 9; laboratory work, *six hours a week.* (X)

Meteorology (Geology *B*).
Mon., Wed., Fri., at 11, a laboratory conference of one hour on Tu. between 9 and 1, and additional laboratory hours. Second half-year. (IV)

Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (X)

And one and one-half courses of elective study.

Fourth Year.

(at the medical school.)

Anatomy.
Physiology.
Histology.
Physiological Chemistry.

FOR TEACHERS OF SCIENCE.

This programme is intended for men who wish to qualify themselves to teach science in secondary schools or to become supervisors of science teaching in elementary schools. The work of the first year is prescribed. During each of the remaining three years the student must complete five courses, one of which must be a course in Education and Teaching; the other four courses the student chooses for himself, but he must obtain his adviser's approval of his choice of studies for each year.

It will be observed that this four years' course combines professional training for teachers and supervisors of teaching with training in science. The several courses in Education and Teaching are designed to furnish this professional training.

Through arrangements made with neighboring cities and towns, students have special opportunities to *teach for practice under direction* in these places.

The attention of graduates of normal schools is especially called to this course.

The degree of Bachelor of Science for Teachers of Science will be conferred on all students who complete this programme satisfactorily.

Prescribed Work of the First Year.

Algebra (Engineering 1*a*).
Mon., Wed., Th., Fri., at 10. First half-year. (III)

Trigonometry (Engineering 1*b*).
I, *Mon., Wed., at 11, with an additional hour for conference. First half-year.* Or II, *Tu., Th., at 10, with an additional hour for conference. Second half-year.* (XI)

Analytic Geometry (Engineering 1*d*).
Mon., Wed., Fri., at 10. Second half-year. (III)

General Introduction to Philosophy (Philosophy 1*a*).
Mon., Wed., Fri., at 2.30. (VII)

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (I and V)

And General Descriptive Chemistry (Chemistry 1).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Or Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.*
Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

Or General Descriptive Physics (Physics 1).

Tu., *Sat.*, *at 12;* laboratory work (*two hours a week*, *Tu.*, *Wed.*, *Th.*, or *Fri.*). (XIII)

Rhetoric and English Composition (English *A*).

Divided into sections. I, *Mon.*, *Wed.*, *Fri.*, *at 10;* II, *Mon.*, *Wed.*, *Fri.*, *at 11;* III, *Mon.*, *Wed.*, *Fri.*, *at 12;* IV, *Tu.*, *Th.*, *Sat.*, *at 10;* V, *Tu.*, *Th.*, *Sat.*, *at 11;* VI, *Tu.*, *Th.*, *Sat.*, *at 12.* (XVI)

And also one full course in German or French in addition to the admission requirements.

Second, Third, and Fourth Years.

During the second, third, and fourth years the student must complete five courses or their equivalent each year, to be chosen with the approval of his adviser, one course each year being selected from the courses in Education.

GENERAL SCIENCE.

This programme of study is intended for those who wish to lay a broad foundation for subsequent special work in Science. The studies in the First-Year are prescribed. In the three subsequent years the studies are to be chosen with the approval of some one Division of Science in the University and the work is to be done under the supervision of this division. For each of these three years five courses are required, and at least one of these courses each year must be taken in the supervising division. In the fourth year, at the option of the supervising division, a thesis may be substituted for one of the five required courses.

The degree of Bachelor of Science in General Science will be conferred on students who complete this programme satisfactorily.

Prescribed Studies for the First Year.

Algebra (Engineering 1*a*).

Mon., *Wed.*, *Th.*, *Fri.*, *at 10. First half-year.* (III)

Trigonometry (Engineering 1*b*).

I, *Mon.*, *Wed.*, *at 11; with an additional hour for conference. First half-year. Or* II, *Tu.*, *Th.*, *at 10; with an additional hour for conference. Second half-year.* (XI)

Analytic Geometry (Engineering 1*d*).

Mon., *Wed.*, *Fri.*, *at 10. Second half-year.* (III)

Mechanical Drawing (Engineering 3*a*).

I, *Mon.*, *at 1.30;* draughting, *Mon.*, *Fri.*, *1.30–4.30;* II, *Tu.*, *at 1.30;* draughting, *Tu.*, *Th.*, *1.30–4.30.* (VI)

Experimental Physics (Physics *B*).
Wed., at 12; laboratory work, *two hours a week.* (I and V)

And General Descriptive Chemistry (Chemistry I).
Mon., Fri., at 12; laboratory work, *Tu., Th., 1.30–3.30, or Wed., Fri., 2.30–4.30.* (V)

Or Experimental Physics (Physics *C*).
Fri., at 1.30; laboratory work, *one afternoon each week from 2 to 6.*
Sections for laboratory work will be arranged for *Mon., Tu., Wed., and Th. afternoons.* (VI)

Or General Descriptive Physics (Physics I).
Tu., Sat., at 12; laboratory work, (*two hours a week, Tu., Wed., Th., or Fri.*). (XIII)

Rhetoric and English Composition (English *A*).
Divided into sections. I, *Mon., Wed., Fri., at 10;* II, *Mon., Wed., Fri., at 11;* III, *Mon., Wed., Fri., at 12;* IV, *Tu., Th., Sat., at 10;* V, *Tu., Th., Sat., at 11;* VI, *Tu., Th., Sat., at 12.* (XVI)

Elementary German (German *D*).
Mon., Wed., Fri., at 9. (II)
Required of students who did not offer German for admission.

Or Elementary French (French *A*).
Three times a week. (IX)
Required of students who did not offer French for admission.

Or Advanced German (German 1*c*).
Tu., Th., Sat., at 9. (X)

Or Advanced French (French 1*c*).
Mon., Wed., Fri., at 9. (II)

Second,* Third, and Fourth Years.

During the second, third, and fourth years the student must take five courses or their equivalent each year, to be chosen with the approval of the supervising division.

* Students who pass English *A* of the first year with a grade of *C*, or lower, are required to take English *B C* in their second year.

DESCRIPTIONS OF COURSES.

The following brief descriptions of the courses required in the various programmes are added for the information of those who contemplate entering the School.

GREEK AND ROMAN ARCHAEOLOGY.

GREEK 10. — The Life of the Ancient Athenians, described and illustrated by the aid of the Literature and of the Monuments. — Lectures, required reading, two short theses. Professor WHITE.

Greek 10 will be given alternately with Latin 10, and is open to Juniors, Seniors, and Graduates. It is intended both for classical students and for others who have not been able to devote special attention in college to the classics, but who may nevertheless wish to make a systematic study of old Greek life. The ability to read Greek and Latin and to use German and French works of reference is desirable but is not required. The instructor will explain in an elementary way, but systematically, how the ancient Athenians lived. He will describe, for example, their houses and how they were furnished; their dress, coverings for the head and feet, and personal ornaments; their system of education; their marriage and funeral rites; entertainments, in-door and out-door sports, markets, shops, exports and imports; the trades and professions among them; their country life; their means of conveyance; how the ship was constructed, manned and rigged; how the horse was bridled and harnessed, etc. The lectures will be illustrated as fully as possible by means of diagrams, casts of works of ancient art, books on art, and the stereopticon, which is provided with over two thousand slides. Lectures will be given on Tuesdays and Thursdays; Saturdays will be devoted to illustration by means of the stereopticon and to collateral reading. The note books of students in this course will be examined monthly.

The course is given by lectures, but members of the class will be required to prepare for examination parts of the books named below, and occasionally also parts of other English books of reference. Of these the instructor will give some explanation and description at the first lecture. No collateral reading will be required in any other language than English; but the instructor will give references also to valuable works written in German and French for the benefit of those who can read these languages. All the books to which reference is made will be reserved for the use of

the class in the College Library or in the Library of the Classical Department. Each member of the course will be required to write two short theses involving elementary investigation.

Smith's *Dictionary of Antiquities* (third edition in two vols., 1890, Little, Brown, and Co., Boston, $7.00 each vol.). Guhl and Koner's *Life of the Greeks and Romans* (Appleton & Co., New York, $2.50), or preferably the sixth German edition under the title, *Das Leben der Griechen und Römer* (Weidmann, Berlin, *M.* 20). Blümner's *Home Life of the Ancient Greeks*, translated by Alice Zimmern (Cassell & Co., London, $2.00), or preferably the sixth German edition under the title, *Leben und Sitten der Griechen* (Freytag, Leipzig, *M.* 4.80). Gardner and Jevons' *Manual of Greek Antiquities* (Charles Scribner's Sons, New York, $4.00). Schreiber's *Atlas of Classical Antiquities* (The Macmillan Co., New York, $6.50).

*Latin 10. — The Private Life of the Romans. — Lectures. — Study of ancient representations. — Required reading and theses on special topics. — Required notes of lectures. Professor Greenough.

Latin 10 is given alternately with Greek 10. All students who have not advanced in Latin as far as Latin 2 must consult the instructor in advance.

This course, open only to Juniors, Seniors, and Graduates, is conducted in the same general way as Greek 10, and is intended to give to classical students and any others fitted to take it, by lectures and the stereopticon, as complete a representation as possible of Roman private life. The equipment for this purpose includes the best illustrated works on classical antiquities, which are accessible to the student in the Library of the Department or in the College Library, and about a thousand stereopticon slides. In addition to the examinations each student will be required to make a certain number of reports on special topics in a somewhat more minute way than the same topics can be treated in the lectures.

ENGLISH.

English *A*. — Rhetoric and English Composition. — A. S. Hill's *Principles of Rhetoric* (revised and enlarged edition). — Lectures, recitations, written exercises, and conferences. Professors A. S. Hill and Briggs, and Messrs. Hurlbut, Copeland, J. G. Hart, Noyes, Greenough, Kidder, P. L. Miller, Rideout, and others.

Mr. Hurlbut will have the general direction of Course *A*.

* Omitted in 1900–01.

Course *A* is prescribed for Freshmen and for First-Year students in the Scientific School. For examinations it is placed in Group XVI.

In the daily exercises the class will be divided into six sections; but at the Mid-Year and Final Examinations the whole class will be examined together.

Course *A* gives instruction in the theory and the practice of English Composition. The theory of composition is taught throughout the year by lectures based on A. S. Hill's *Principles of Rhetoric* (revised and enlarged edition), and by oral and written exercises. The practice is obtained in daily themes, some of which are written in the class-room on topics announced after the class has assembled; and in longer themes, prepared at intervals of about a fortnight. The long themes and a considerable number of the daily themes are criticised in detail by the instructors and returned to the writers to be rewritten, some in the class-room under the immediate supervision of an instructor.

For the writing of class-room themes the class is divided into six sections, which meet the instructors on Wednesdays or Thursdays; for the study of Rhetoric and the rewriting of themes in the class-room each section is subdivided into three or more parts. Furthermore, regular consultation hours are appointed; and each student is required, at frequent intervals, to discuss his work with his instructor.

In addition to the study of Rhetoric and the writing and rewriting of themes, certain reading is required, but not more than one book a month. Among the books which have been prescribed are *Henry V.*, *Macbeth*, *Revolt of a Tartar Tribe*, *The Essays of Elia*, *The Scarlet Letter*, *The Golden Treasury*, *Treasure Island*, *The Jungle Book*, *Henry Esmond*, *David Copperfield*, and in general such books as the students in the course might read for their own pleasure.

Students in the programme in General Science who attain Grade *B*, or higher, in Course *A* are exempted from the prescription of Course *B C*. Students in all other programmes who attain Grade *C*, or higher, in Course *A* are exempted from the prescription of English *B C*.

English *BC*. — English Composition. — Written exercises, and conferences. Mr. T. Hall.

Course *BC* is prescribed for all students in the Scientific School who have passed in Course *A* with a grade lower than *C*. It is prescribed for students in the programme in General Science who pass English *A* with a grade lower than *B*. It is open only to those who have passed in Course *A*.

Course *BC* gives instruction in the elements and the qualities of style, and practice in Narration and Description, but mainly in Expository writ-

ing. It is specially adapted to the needs of students in the Scientific School, and to this end it is closely connected with their other courses.

The class meets at lectures once each week, and each student meets an instructor for personal consultation at least once in two weeks.

The written work consists of daily themes, fortnightly themes, and a thesis of not less than 1500 words. The thesis and some of the fortnightly themes are preceded by plans.

☞ No overdue theme will be accepted unless the writer satisfies the Secretary of the Scientific School that his failure to present it at the appointed times was unavoidable.

GERMAN.

GERMAN *D*. — Elementary Course. — Grammar. — Translation from German into English, and elementary exercises in translating into German. Mr. HOWARD, Dr. SKINNER and Mr. RIEMER.

Course *D* is intended for students of the Lawrence Scientific School who did not present German at the examination for admission. The work of the course will be conducted in several sections meeting at the hour announced. At the mid-year and final examinations the class will be examined in one division.

The principal aim of Course *D* is to give the student a knowledge of German sufficient to enable him to read easy German at sight.

GERMAN 1*c*. — German Prose. — Subjects in Natural Science. — Reading at sight. Dr. BIERWIRTH.

Course 1*c* is intended for students who have taken Course *A* or *D* or who presented Elementary German for admission. It may also be taken (to count as a half-course only) by students who take or have taken Courses *B*, *C*, 1*a*, or 1*b*; or who presented Advanced German for admission. It will not remove a condition in Advanced German.

This course is intended to furnish drill in the reading of modern scientific German, and is recommended to students who are taking, or who plan to take, special courses in Natural Science or in Medicine. An elementary knowledge of at least two of the Natural Sciences is requisite for success in this course. Dippold's *Scientific German Reader* is used as an introduction, and is followed by monographs on various subjects, in order to give the student as large a vocabulary as possible. The reading matter is taken from such books as: Hirzel's *Chemie;* Brewer's *Naturlehre;* Müller's *Die elektrischen Maschinen;* Helmholtz's *Ueber Goethe's Naturwissenschaftliche Arbeiten.*

FRENCH.

FRENCH *A*. — Elementary Course. — French Prose and Composition. Messrs. C. H. C. WRIGHT, LA MESLÉE, and HENNING.

There will be at least three sections in this course, but all sections will be examined in Group IX. The choice of sections, by students who have no conflict with an elective course, is subject to the approval of the instructor. Students in the Lawrence Scientific School are required to to enter Section I.

This course is equivalent to the Elementary French of the admission requirements, and is prescribed for Freshmen who did not present French for admission.

The object of this course is to prepare students to follow the more advanced courses, but it may be taken by those desiring simply to acquire a fair reading knowledge of French. The work consists largely of translation from French into English, of sight-reading of simple French, and of translation from English into French, the exercises illustrating the elementary rules of grammar and the simpler rules of syntax, which are required to facilitate sight-reading of simple French prose. During the second half-year connected passages of translation from English into French, short and easy summaries, in French, of passages from the books read in class, and easy dictations in French, form an important part of the work.

The following books will be used: Chardenal's *Complete French Course* (Allyn & Bacon); Grandgent's *Materials for French Composition*, Part I; Michelet, *Jeanne d'Arc;* Ludovic Halévy, *l'Abbé Constantin;* Anatole France, *le Crime de Sylvestre Bonnard* (Holt & Co.); Émile de Bonnechose, *Bertrand du Guesclin* (Macmillan & Co.); George Sand, *la Mare au Diable* (Heath & Co.). At the final examination the student will be expected to have a knowledge of Elementary French grammar, to be able to translate at sight a passage of ordinary French prose, and to write an easy French composition.

FRENCH 1*c*. — Reading, Translation, Grammar, and Composition. Dr. FORD and Mr. HENNING.

Open to students who have passed in Course *A*, or have passed the admission examination in Elementary French.

This course is conducted mainly in English.

It is intended primarily for students in the Lawrence Scientific School who have passed in Elementary French for admission; for them it is a prescribed course.

The object of this course is to lead the student to understand both the spoken and the written language; to enable him to read easily at sight and to write with a fair degree of accuracy. The work consists of exercises in composition illustrating the principles of the grammar and the more frequent rules of syntax, of dictations in French, of short summaries of the books read, of much translation of French into English, and of a large amount of sight-reading of French.

The following works will be used: Grandgent's *Essentials of French Grammar* (Heath & Co.); Sarcey, *le Siège de Paris* (Heath & Co.): Ségur, *la Retraite de Moscou* (Holt & Co.); Luquiens, *Popular Science* (Ginn & Co.); Dumas père, *les Trois Mousquetaires* (Ginn & Co.); Corneille, *Rodogune;* Coppée, *le Pater* (Ginn & Co.); Mérimée, *la Chronique du règne de Charles IX* (Heath & Co.); George Sand. *Marianne;* Aubert, *Physiologie et anatomie animales* (André Guédon): Troost, *Précis de chimie* (Masson).

SPANISH.

Spanish 1. — Grammar, reading, and composition. — Modern novels and plays. Dr. Ford and Mr. Cusachs.

Sections I and II will be examined in Group VI, and Section III in Group VII.

Students are not permitted to elect Italian 1 and Spanish 1 in the same year.

This course is elementary, and its object is to give the essentials of Spanish grammar (both forms and syntax), as a preparation for reading and writing the language. The translation of modern Spanish prose will be begun early in the year; and there will be much practice in rendering easy English into Spanish. Ramsey's *Text-Book of Modern Spanish* will be used for the grammatical instruction. Stories and plays by modern authors (Valera, Pérez Galdós, and others) will be read. It is expected that the student will find himself able at the end of the year to read ordinary modern prose with only occasional difficulties of vocabulary and idiom.

This course or its equivalent is a necessary preparation for Course 5.

PHILOSOPHY.

Philosophy 1*a*. — General Introduction to Philosophy. — *First half-year:* Psychology, Professor Münsterberg; *Second half-year:* Logic, Dr. Miller. — James's Psychology (briefer course); Jevons's Lessons in Logic. Professors Münsterberg and Dr. Miller, assisted by Dr. Rand.

The instruction will be by lectures, by text-books, and by assigned private reading. Each student will meet an assistant in conference at frequent intervals.

Philosophy 10. — Aesthetics. — The Philosophy of Art, with a survey of Aesthetic Theories. Asst. Professor Santayana.

The object of this course will be to present a connected view of the relations of aesthetic to scientific and moral interests. The theories of Plato and Aristotle, and those of Lessing, Schopenhauer, and Hegel will be expounded and criticised. The reading will consist of portions of the writings of these or allied authors, on which short reports will be handed in.

EDUCATION.

Education 1. — The History of Educational Theories and Practice. — Lectures, required reading, and reports. Mr. Norton.

The object of this course is to make the student acquainted with the educational aims and practices of the past and with the most important educational classics, and thus enable him to obtain a foundation for the criticism of present theories and practices in the light of their historical evolution, and, incidentally, to acquire many rules for guidance in the actual work of teaching.

Education in Greece, Rome, and during the Middle Ages will be briefly considered. Most of the year will be devoted to the history of Education since the Renaissance in Europe, and some time will be given to the history of Education in the United States. Essays are required and a course of reading is prescribed.

Education 2. — Introduction to Educational Theory. — Discussion of Educational Principles. — Lectures, essays, and discussions. Asst. Professor Hanus.

The aim of this course is to enable the student to attain the conception that Education is a rationalized endeavor rather than a mere routine, and

to make a critical examination of such generally accepted educational principles as may serve to guide the student in his further study of educational questions. The meaning and scope of Education are defined, and its aims, means, and methods are examined. The special aims and general method of elementary and secondary education are treated separately and also in relation to each other. The following topics indicate the general character of the work: General Principles of Education including the Scope and Meaning of Education; the relation of Psychology to Educational Theory and Practice; the Development of the Individual and his Adaptation to the Civilization of his time; the Special Aims of Elementary and Secondary Education; Educational Values and Courses of Study; the Correlation of Studies; General Principles of Method; the Bearing of Instruction on Character; Discipline and Moral Training; the Study of Children; School Hygiene. The remaining time will be devoted to a study of selected educational literature. A course of reading is prescribed, and essays are required.

Education 3. — Organization and Management of Public Schools and Academies. — Courses of Study, Supervision, and Teaching. — Lectures, discussions, and reports. Asst. Professor Hanus, assisted by Mr. Norton.

The general aim of this course is to enable all students to become familiar with and to understand the organization and administration of schools and school systems through direct observation and comparative study; to provide for young graduates and other students of suitable age and attainments an opportunity to acquire the art of teaching through study and practice; and to provide, through the opportunity for specialization which the course affords, special preparation for the work of principals and superintendents of schools. The course will be carried on in two sections, in accordance with the attainments, previous experience, and aims of the students. While much of the work is the same for both sections, the treatment of the same topics will differ somewhat in the two sections, and in Section II special attention will be given to the work of the class-room teacher, while in Section I special attention will be given to the duties of principals and superintendents of schools. During the year, the students of Section II will have an opportunity to teach, under direction, in schools in the vicinity of the University, and it is expected that all graduate students who have had no experience as teachers will avail themselves of this privilege to the extent of at least two periods a week during half a year. While this privilege of practice teaching is offered primarily to graduate students, yet other students of suitable age and attainments are not excluded from this privilege. But any student

who shows a persistent unfitness to teach will not be permitted to continue his practice teaching. In studying the school systems of American cities, a detailed examination of their courses of study will be undertaken, and the principles on which any course of study should be based will be discussed. Attention will be given to details of the organization and administration of schools and school systems. The duties of teachers, principals, and superintendents will be considered separately, and in relation to each other. Students will study, under direction, the work of public schools and academies in the vicinity of the University. Reports of this work, written when required, will be submitted weekly. A course of reading is prescribed. At the end of the year each student will submit a thesis on the organization and work of a city school system, in which special attention must be given either to the course of study or to a detailed discussion of organization and management. In the first case, the student will be expected to treat particularly his own specialty, for which all the details of the course of study, the teaching resources, and the methods of teaching, must be fully considered. In the second case, the student must develop his own plan for the organization and administration of a school system in detail, on the basis of a comparative study of existing systems.

EDUCATION 4. — Foreign School Systems. — The school systems of England, France, and one or two German states. — Lectures, essays, and special reports. Asst. Professor HANUS.

The aim of this course is to acquaint the student with the chief characteristics of the school systems of England, France, and Germany, and to compare those school systems with each other and with the school systems of the United States. A brief account of the recent history of the school systems of each country will lead to the study of each system as at present organized and administered. The following topics will be treated in some detail: State Control and Local Control of Schools; Financial Support of Schools; Supervision; Elementary Schools, — Courses of Study, Methods, and Discipline; Continuation Schools; Secondary Schools, — Courses of Study, Methods, and Discipline; Rights and Privileges of Secondary School Graduates; the Training of Teachers for Elementary and for Secondary Schools. If time permits, foreign universities will be briefly considered. A course of reading is prescribed and essays are required.

EDUCATION 10*a*. — The Methods and Equipments of a Teacher of the Classics in Secondary Schools. — Lectures, discussions, required reading, and illustrations of class work. Asst. Professor PARKER.

The lectures and discussions will deal with the methods of teaching vocabulary, exercises, parsing, reading, etc., to beginners in Latin and

Greek. The conversational method and the inductive method will also be considered. The time and manner of using readers, of teaching the various authors used in schools, of giving systematic drill in grammar, of brightening up the daily lessons, of teaching to read at sight, and to write in Latin and Greek, — all these will be discussed. The most important text-books will be named and compared. The arrangement of courses in Latin and Greek for high schools and other secondary schools will be examined; the fitting out of the school library and class room with books, maps, etc., will be suggested. About ten of the meetings of the course will be given to the actual teaching of set lessons. Every member of the course is expected to read about a hundred new pages of Latin and as many of Greek. This work will be tested in oral consultations and at the final examination. Written answers to questions based on the lectures will be expected every week. The final examination will test all the different kinds of work that have been done. No one will be admitted to the course unless he can show that he has made considerable progress in the study of Greek and Latin.

EDUCATION 10*b*. — The Methods and Equipment of a Teacher of German in Secondary Schools. — Lectures, discussions, required reading, and illustrations of class work. Dr. BIERWIRTH.

Among the subjects treated in the lectures and discussions are the following: the adaptations of methods to the age and previous training of students; the arrangement of courses in different schools; the choice of text-books; the annotation of texts; the teachers' sources of information; the disciplinary and practical value of the study of German and its relation to the study of English. — Students taking the course are required to prepare reports on grammars, readers, or editions of texts, interpret or annotate new texts, and present to the class some of the more difficult topics in grammar, syntax, and composition.

EDUCATION 20. — Pedagogical Seminary. — *Subject for the year:* Contemporary Problems in Education. — Lectures, essays, reports, and discussions. Asst. Professor HANUS.

This course is intended only for the most advanced students. At the outset a general survey of present problems in education will be undertaken. Such problems include questions pertaining to the Improvement of the School Course of Study, City and District Organization of Schools and School Systems, the Proper Equipment for Effective Work, and the Methods of Teaching. Soon after the Seminary is organized, each member is expected to select some topic or topics for special study, and later,

to present the results of this study to the Seminary in the form of at least one essay during each half-year. Much stress is laid on the essays and the discussions based on them. In addition to the work in his special topic, each member of the Seminary is required during the year to submit to the instructor a critical discussion of the educational doctrines of one of the following educational reformers: Comenius, Rousseau, Pestalozzi, Froebel, Herbart, Mann, Eliot; and to present a written report once a month on the bibliography of that part of the field of education in which he is especially interested.

FINE ARTS.

FINE ARTS 1. — Principles of delineation, color and chiaroscuro. — Lectures (once a week) with collateral reading. — Practice in drawing and in the use of water-colors. — Perspective. Professor CHARLES H. MOORE, assisted by Mr. MOWER.

This is a course on the theory of the graphic arts as modes of expression. It at the same time includes the study of nature from an artistic point of view, and aims to cultivate the eye, and in some measure to train the hand. The instruction is given by lectures and collateral reading and by practice in drawing with the point and in water-colors. In the drawing and coloring exercises the theoretic aim of this course is kept steadily in view. These exercises serve to fix in the mind of the student the fundamental principles of graphic art, and for the student of architecture a solid foundation is laid for the continued practice in freehand drawing which is to follow.

The books chiefly referred to will be the following: Ruskin's *Modern Painters* and *Elements of Drawing;* Longfellow's *Abstract of Lectures in Perspective;* Sir Joshua Reynold's *Discourses;* Hammerton's *Thoughts about Art.*

FINE ARTS 2. — Principles of Design in Architecture, Sculpture and Painting as exemplified in the Arts of past ages. — Lectures (*twice a week*), with collateral reading. — Practice in drawing. Professor CHARLES H. MOORE.

As a preparation for Course 2 it is desirable to have passed satisfactorily in Course 1. See, further, note under Course 4.

FINE ARTS 3. — The History of Greek Art with an Introduction on the Arts of Egypt, Assyria, and Phoenicia, in their relation to Greek Art. Mr. EDWARD ROBINSON.

FINE ARTS 4. — The Fine Arts of the Middle Ages and the Renaissance. Professor CHARLES H. MOORE.

Courses 2 and 4 cannot both be counted towards a degree by the same student.

Courses 3 and 4 in the Department of Fine Arts are devoted to the history of these arts from the earliest times to the seventeenth century of our era. In Course 3 the general characteristics of the arts of Egypt and Assyria are treated, but special attention is given to the development and principles of Greek art with reference to its importance as an illustration of the life and spirit of the Greeks, in connection with the other forms in which their genius showed itself, and with the events of their political history.

Course 4 deals in a similar manner with the architecture, sculpture, and painting of the Romans, of the Midlde Ages ,and of the Renaissance.

ARCHITECTURE.

ARCHITECTURE 1*a*. — Technical and Historical Development of the Ancient Styles, with special reference to Classic Architecture. —Lectures and practice in drawing. Professor H. L. WARREN.

This course is open to students in the College who satisfy the instructor of their fitness to pursue it.

The first few weeks of the course are devoted to gaining facility in the simple representation of architectural form, with some study of the elementary principles of projection and perspective drawing and shades and shadows. The history of ancient architecture is then taken up. The gradual development of architectural forms and the technical processes of building are traced, beginning with a summary study of the buildings of Egypt, Assyria, and Persia, and passing on to the more thorough and detailed consideration of the architecture of Greece and Rome. Students are required from time to time to make drawings and written reports in illustration of the lectures. During the course the elements of Classical architectural form, especially the Greek and Roman orders, and their uses are considered. The more important buildings are examined in detail, and the structural and aesthetic principles on which their design depends are studied critically. The course is so conducted as to make the greatest possible use of the library and to familiarize the student with books and their use. The course is not

merely historical, but aims to lay the foundation of a working knowledge of architectural form and thus serves as an introduction both to Courses 1*b* and 1*c*, which continue the history of architecture, and to Course 4*a*, which begins the study of architectural design. The courses in history include a study of ornament and of the principles of ornamental design.

N. B. — The ability to use French and German reference-books with ease will be found valuable, though not essential.

Reference-books: Reber, *History of Ancient Art;* Perrot and Chipiez, *History of Art in Ancient Egypt; — in Chaldaea and Assyria; — in Persia;* Maspero, *Egyptian Archaeology;* Babelon, *Manual of Oriental Antiquities;* Laloux, *l'Architecture grecque;* Durm, *Die Baukunst der Griechen;* Durm, *Die Baukunst der Etrusker und Römer;* Martha, *l'Archéologie etrusque et romaine;* Choisy, *l'Art de bâtir chez les Romains;* Bühlmann, *Die Architektur des classichen Alterthums und der Renaissance.*

ARCHITECTURE 1*b*. — Technical and Historical Development of the Mediaeval Styles of Architecture. — Lectures and practice in the drawing-room. Professor H. L. WARREN.

ARCHITECTURE 1*c*. — Technical and Historical Development of the Renaissance and Modern Styles of Architecture. — Lectures and practice in drawing. Professor H. L. WARREN.

Courses 1*b* and 1*c* are given in alternate years, and are taken by the Second and Third-Year men together, so that one set of students, following the chronological order, continues the studies of the First-Year, which close with the decline of Roman art, by taking up in the Second-Year the study of the Mediaeval art which grew out of that decline, and completes the history of architecture in the Renaissance and Modern styles; while another set of students passes from Roman architecture to its revival in the fifteenth century, and goes back to study the Mediaeval styles.

In these courses the study of the history of architecture is continued by means of lectures and the making of drawings, written reports and theses illustrative of them by the students. There is the same insistence on the requirement of familiarity with the forms that are met with, and their proper use. From time to time special subjects of research are given out which the students are expected to investigate for themselves, under guidance, by means of engravings and photographs, and upon which written reports will be required.

The courses include consideration of the history of ornament.

The endeavor is to study the history of architecture not so much archaeologically as in a more vital way with reference to actual practice; to obtain a knowledge of principles of design by an analysis of the growth

of architectural form and its use. The buildings that are studied are regarded not as objects of contemplation or as historical documents, but as examples of various methods of work carried out under certain conditions. Architectural form and composition are thus studied by means of the history of architecture.

Reference-books: In Course 1*b* — Essenwein, *Die Ausgänge der classischen Baukunst;* Essenwein, *Die Fortsetzung der classichen Baukunst im oströmischen Reiche;* Choisy, *l'Art de bâtir chez les Byzantins;* Bayet, *l'Art byzantin;* Dehio und v. Bezold, *Kirchliche Baukunst des Abendlandes;* Moore, *Development and Character of Gothic Architecture;* Violet-le-Duc, *Dictionnaire raisonné de l'architecture française;* Chateau, *l'Architecture en France;* Parker, *Introduction to the study of Gothic Architecture;* or *A B C of Gothic Architecture;* Paley, *Gothic Mouldings.* In Course 1*c* — Burkhardt, *Geschichte der Renaissance in Italien; Der Cicerone;* Symonds, *The Renaissance in Italy;* Anderson, *Architecture of the Renaissance in Italy;* Lübke, *Die Renaissance in Frankreich; Geschichte der deutschen Renaissance;* Muentz, *Histoire de l'Art pendant la Renaissance;* Blomfield, *The History of Renaissance Architecture in England.*

ARCHITECTURE 2*a*. — Elementary Architectural Drawing. Professor H. L. WARREN and Mr. NEWTON, assisted by Mr. SWAN.

This course is illustrative of Course 1*a*, and is open only, except by special permission, to those students who are taking Course 1*a* in the same year.

The drawing-room is open to students day and evening. An instructor is usually present during the day-time. Students of architecture in their First-Year should give all their spare time to their drawing.

After some preliminary work the time is devoted to making a series of carefully rendered drawings of simple buildings, or portions of buildings, and of standard examples of each of the orders. This not only gives the necessary practice in draughtsmanship, but familiarizes the student with the best forms of the orders. Students are encouraged to make their own selection of the examples to be drawn, subject to the approval of the instructors. The drawings form in effect a series of illustrations to the lectures in Course 1*a*. An exhibition is made of each series of plates as completed, and the work is then criticised before the class.

ARCHITECTURE 3*a*. — Freehand Drawing. Professor H. L. WARREN, assisted by Mr. SWAN.

This is a course for practice in drawing especially arranged for students of architecture, in continuation of Fine Arts 1. It includes practice with

pencil, pen, and brush, giving the student a careful training in the simplest method of expressing an architectural subject, whether a fragment of detail or a building.

ARCHITECTURE 3*b*. — Freehand Drawing (second course). Professor H. L. WARREN and Mr. NEWTON, assisted by Mr. SWAN.

In this course the student is permitted more freedom, and individuality in the handling of his subject is encouraged. The works of the best draughtsmen are put before him, and after the severer training of the preceding course he may treat his subjects in his own way under the direction of the instructor, always with a view to producing a pleasing composition in light and shade, as well as in form.

ARCHITECTURE 3*c*. — Freehand Drawing from Architectural Subjects (third course). Professor H. L. WARREN and Mr. NEWTON.

Especial attention will be given in this course to the composition of drawings, which is not only essential to the artistic presentation of architectural subjects, but is of great aid in cultivating the sense of composition in architectural design, which depends upon the same principles. Studies principally from Turner, Harding, Cotman, and Claude Lorraine will be carried on. In the latter part of the course instruction will be given in figure drawing, the casts in the Fogg Art Museum from the antique and from mediaeval and renaissance masters being used as models.

These courses give the necessary daily practice in freehand drawing, which alone will enable the student of architecture to obtain the knowledge of form and facility in its representation which an architect needs. Instruction is given in the use of pencil, pen, and water-colors. Work will be done from the flat and from the round. The increasing collection of examples of good draughtsmanship, which the department possesses, and the photographs and casts will be used as models. Nearly all the work will be done from architectural subjects, so that the student may be adding to his store of knowledge of architectural form at the same time that he acquires mastery of hand.

ARCHITECTURE 4*a*. — Elementary Architectural Design. Professor H. L. WARREN and Mr. NEWTON, assisted by Mr. SWAN.

This course is open to those students only who have passed satisfactorily in Architecture 1*a* and 2*a*, or satisfy the instructors that they have

done equivalent work. *All the courses in design will require the student to devote all the time he can possibly give to the work.* During the first weeks of the course the student is occupied in making carefully rendered drawings from measurements of actual examples of architectural composition. Following this introduction the study of architectural design will be further pursued (1) by means of occasional lectures on the principles of design and of planning, (2) by exercises in design from dictation, by means of which the memory and imagination of the student will be stimulated and the knowledge of form acquired during the first year will be made use of and fixed in mind, and (3) by means of problems of an elementary nature, which will be given out from time to time as exercises in original composition. These designs will be carefully elaborated under the constant direction and criticism of the instructors, and when completed will be criticised before the whole class.

ARCHITECTURE 4*b*. — Architectural Design (second course). Professor H. L. WARREN and Mr. NEWTON.

This course is open to students who have passed satisfactorily in Course 4*a*, of which it is a continuation.

As in the previous course, the work will be carried on by means of problems and criticisms, and occasional lectures. The study of planning will be taken up systematically, and lectures will be delivered on the right artistic treatment of the various materials used in building.

In the work in design the forms of classical architecture will be mainly used, as the object of the course is to give a mastery of technique and of composition, and this can better be done by endeavoring to secure as complete a mastery of one style as the limited time of the course will allow, rather than by scattering the energies in an impossible attempt to secure adequate knowledge of several styles. Some exercise in historic designs in other styles will be given. For this purpose the classical styles are preferred because of the simplicity of their fundamental forms and because these forms lie at the foundation of all modern styles. The problems proposed in the courses in design will be selected with a view to stimulating as far as possible whatever imagination or poetic feeling the student may possess at the same time that they give practice in various classes of architectural composition. In the main they will be such as depend upon present American conditions: not merely conventional school problems without relation to our time or civilization.

In carrying on the work of this course the department is assisted in some of the problems by the members of the Committee appointed by the Board of Overseers, as described on page 117.

ARCHITECTURE 4c. — Architectural Design (advanced course.) — Lectures and practice. Professor H. L. WARREN and Mr. NEWTON.

This course is open to students who have passed satisfactorily in Course 4*b*. The method of instruction will be the same as in the previous course. It will include the study of the planning and arrangement of important buildings. The second half of the year will be devoted to the making and complete presentation of a design for some important structure, which will be presented as a Thesis.

ARCHITECTURE 5. — Construction. — Carpentry. — Lectures and drawing. Mr. NEWTON.

A careful study is made in this course of the framing of simple structures, such as an ordinary framed house, and of the details of carpentry construction. The joints of timbers in floors and roof trusses, the construction of window and door frames, wooden staircases and the like receive full consideration.

ARCHITECTURE 6. — Practice in modelling architectural ornament in clay. Mr. GARBUTT.

ARCHITECTURE 7 — Theory of Design. — Pure Design (Balance, Rhythm, Harmony) and Design in Representation. Lectures, with experimental practice; study of examples. Dr. ROSS.

The spot of paint as a term of expression. Its tone, its measure, its shape. Thinking in tones, measures, and shapes. Expression of the thought by painting.

Pure Design: the composition of tones, measures, and shapes, for the sake of Rhythm, Balance, Harmony, the principles of Order, of Beauty. Definition and explanation of these principles. Exercises in designing; designing in black and white; in values (different measures of light in the black-to-white scale); in color-values, or tones. Different systems of color-values. Tone-rhythms, tone-balances, harmony of tones. Pure Design compared with Music. Appeal of Music to the ear, of Pure Design to the eye. The undeveloped possibilities of Pure Design.

Design in Representation. The object as represented by the visual image. Advancement of knowledge (science) by the definition of the visual image, as hypothesis, and by the comparison of the definition with the object (the facts of observation). The advancement of knowledge not, necessarily, an advancement of Art. Artistic representation; knowledge in forms of design. Importance of design in connection with Representation.

The history and development of the Fine Arts: Gymnastics (including dancing), Music, Poetry, Architecture, and Sculpture; Painting particularly described, in its developments and history. Painting in the East (China and Japan) and in Western Europe. Different modes of Pure Design and of Design as applied in Representation. Study of examples and illustrations.

First object of the course: to induce an activity of imagination (the habit of thinking in tones, measures, and shapes). Second object: to get this activity of imagination under the control of the principles of design (Rhythm, Balance, Harmony) and under the control of scientific knowledge. Art defined as the expression of Life, as excellence in the matter of expression, as design in forms of expression, — doing what we have to do, what we want to do, just as well as it can be done.

LANDSCAPE DESIGN.

Landscape Design 1. — History and Principles of Landscape Design. — Mr. Olmsted, with occasional lectures by Professors Shaler and Goodale.

The object of this course is to give the students a broad knowledge of many types of landscape and garden forms, of the elements which make up the quality of each, of the motives which underlie them when of artificial creation, of their limitations, and of the constant adaptation of means to ends in all good work. The instruction is in the form of lectures, supplemented by collateral reading, by informal conferences and by frequent exercises in writing or drawing for the purpose of impressing the instruction upon the students and assuring the instructor that he is understood. The types of landscape and garden design are taken up in the historical order of their highest development, but in addition to the critical description of historical examples with the aid of plans, drawings and photographs, reference is made whenever possible to actual examples, illustrative of the same principles, to be found in the vicinity of Boston. Students are expected to visit these examples and to make reports upon them.

In connection with this course the relation of landscape to geological structure, to climatic conditions and to vegetation, and the relation of both formal and informal design to natural limitations, will be set forth in a series of lectures by Professors Shaler and Goodale.

Reference-books will be announced later.

Landscape Design 2. — Practice in Landscape Design (first course). Mr. Olmsted, assisted by Mr. Shurtleff.

LANDSCAPE DESIGN 3. — Practice in Landscape Design (second course). Mr. OLMSTED, assisted by Mr. SHURTLEFF.

Courses 2 and 3 are open only to those students who have passed satisfactorily in Course I, and in the Landscape section of Architecture 4*a*, or satisfy the instructors that they have done equivalent work. The two courses are to be taken in successive years and form in effect a single course extending over two years and requiring the student to devote the chief part of his time and attention to the subject. One or both of the instructors will be present on Mondays and Fridays from 9 A.M. to 5 P.M. and occasionally on Wednesdays, but the drawing room is open every day from 9 A.M. to 10 P.M. and the students are expected to make diligent use of their time between conferences with the instructors. The work consists chiefly of the solution by the students of actual problems presented to them in definite form by the instructors. So far as is practicable, land in the vicinity of Cambridge is chosen for study and treatment, so that the student may have practice in that nice adjustment of plan to natural conditions which is one of the essentials of good work. In at least one important problem the topographical surveys upon which the students' plans are based are made by themselves, and they are given practice in devising somewhat detailed construction plans for the more important portions of each of the general plans which they prepare. In the conduct of these courses, except for occasional lectures upon principles applying to the work in hand and frequent criticism of plans before the class as a whole, the conditions are made to approximate those of actual office practice as closely as possible. The elaboration of planting plans in connection with the general plans prepared in these courses is included in Horticulture 2 and 3, but the work is so arranged that the two sets of courses keep in close touch. In the latter part of course 3, the work of the student is devoted chiefly to the preparation of a thesis, involving both a written report and plan, upon a subject approved by the instructors.

It is hoped that somewhat extended excursions can be arranged during the Summer for the purpose of studying parks and private places which have been designed for conditions not found in the vicinity of Boston.

Reference-books will be announced later.

ENGINEERING COURSES.

ENGINEERING 1*a*. — Algebra. Messrs. LOVE, ASHTON, FRIZELL, and CAMPBELL.

This course is not open to students of Harvard College, except by permission of the instructors.

Some of the topics to be studied are surds, imaginaries, quadratic equations, theory of quadratic equations, binomial theorem, theory of equations, simultaneous equations of degree higher than the first, undetermined coefficients, partial fractions, inequalities, variables and limits, the progressions, series and convergency.

The *text-book* will be announced at the beginning of the course.

ENGINEERING 1*b*. — Trigonometry. Messrs. LOVE, ASHTON, FRIZELL, and CAMPBELL.

This course cannot be counted towards the degree of A.B.

The topics treated will include the trigonometric functions, solution of triangles, radian measure of angles, logarithms, trigonometric equations, and identities, with some of the applications of these subjects.

The section meeting during the first half-year is intended for students of Architecture, Landscape Architecture, and for those who have offered advanced Algebra for admission.

The *text-book* will be announced at the beginning of the course.

ENGINEERING 1*d*. — Analytic Geometry. Messrs. LOVE, ASHTON, FRIZELL and CAMPBELL.

This course is open to students who have passed satisfactorily in Course 1*a* or its equivalent, and who take or have passed satisfactorily in Course 1*b* or its equivalent.

The work will include a study of the straight line, the circle, the ellipse, the parabola, the hyperbola, and other important plane curves. Both rectangular and polar coördinates will be used. It is expected that some time will be given to the elements of solid analytic geometry.

The *text-book* will be announced at the beginning of the course.

ENGINEERING 1*c*. — Differential and Integral Calculus. Messrs. LOVE and ASHTON.

This course is open to students who have passed satisfactorily in Course 1*d*, or its equivalent. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

Some of the topics treated in this course are differentiation, anti-differentiation, integration, and their applications to tangents, normals, areas, volumes, lengths, surfaces, curvature, evolutes, maxima and minima, indeterminate forms, development in series, computation by series, centres of gravity, moments of inertia, and motion. Partial differentiation and multiple integration will be treated and applications made to problems in geometry and mechanics.

Text-book: Love's *Introductory Course in the Differential and Integral Calculus.*

ENGINEERING 1*f*. — Integral Calculus, and Differential Equations. Mr. LOVE.

This course is open to students who have passed satisfactorily in Course 1*c*, or its equivalent. It is intended as an optional course for third or fourth year students in the Scientific School.

The work in this course includes a review and elaboration of some of the topics introduced in Course 1*c*, followed by further applications of the calculus to problems in geometry, physics, and mechanics. The simpler methods of solving differential equations will be presented and illustrated by numerous examples and applications.

Text-books: Love's *Introductory Course in the Differential and Integral Calculus;* Murray's *Differential Equations.*

ENGINEERING 3*a*. — Mechanical Drawing. — Use of Instruments. — Projections and Machine Drawing. Messrs. MOSES, KENNEDY, MOYER, and ——.

This course is introductory and is prescribed for all candidates for a degree in Engineering. It does not count for Honorable Mention.

It is intended to supply a good working knowledge of the elements of mechanical and freehand projection drawing, and of their application to the representation of machinery and other engineering structures. It also serves as an introduction to Descriptive Geometry and other courses requiring a knowledge of drawing. At the end of the course, students are expected to understand and to read mechanical drawings and to have some facility in the measurement and delineation of machines and structures. Particular attention is paid to rapid freehand work made as nearly as possible to scale.

The topics of the course in the order in which they are taken up are as follows. During the first half-year: — the use of instruments; problems in geometrical drawing; orthographic and isometric projections; tracing and blue printing; and the practice of freehand sketching and lettering.

During the second half-year: — working drawings of machines and structures with a continuation of freehand sketching; the stretching of paper and practice in india-ink and color tinting.

Reference-books: Anthony's *Mechanical Drawing* and *Machine Drawing*.

ENGINEERING 3*b*. — Descriptive Geometry. — Elementary Shades, Shadows, and Perspective. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*a* or Architecture 2*a*.

It consists mainly of the application of the principles of Descriptive Geometry to problems in the projection, intersection, and development of geometrical forms of common occurrence in Engineering and Architecture, which cannot be solved by the ordinary processes of projection drawing. A method of arrangement of the planes of projection, auxiliary cutting planes, etc., is used which is consistent with the generally accepted conventions of projection and machine drawing and avoids some of the complexity and inconvenience of the methods usually adopted for the solution of problems in descriptive geometry. The course also includes problems in shades and shadows, and in perspective, the general theories of these subjects being given with their application to simple forms.

Text-book: Instructor's Notes.

ENGINEERING 3*d*. — Mechanism. — Study of gearing and mechanical movements. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*a*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

In this course the transmission and change of motion by means of toothed wheels, link work, belts, and special devices are taken up in both their theoretical and practical aspects. Problems involving these different modes of transmission are worked out in the draughting-room, particular attention being paid to the construction of teeth of wheels by exact and approximate methods. Analyses of simple machinery and calculations for trains of wheel work, belting, etc., are made in order to give the student thorough grounding in the principles of pure mechanism.

Reference-book: Barr's *Kinematics of Machinery*.

ENGINEERING 3*e*. — Stereotomy, Shades, Shadows, and Perspective. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*b*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

The course consists of problems in stereotomy, or stone-cutting, and in shades, shadows, and perspective. In stereotomy, drawings are made of constructions in stone with the working out of the necessary details and the developments of the separate parts. In shades, shadows, and perspective special attention is given to architectural forms and to the shorter practical methods in general use by architects.

Text-books: Siebert and Biggin's *Modern Stone Cutting and Masonry;* Millard's *Shades and Shadows.*

ENGINEERING 4*a*. — Surveying. — Use of Instruments. — Plane and Topographical Surveying, Topographical Drawing and Leveling. — Field practice. Messrs. TURNER and ——.

This course is open to students who have studied Plane Trigonometry. See note under Course 4*d*.

The work of this course consists of the study of the theory and adjustments of the several surveying instruments, together with their practical use in the field. The field surveys consist of differential and profile levelling; chain, compass, and transit land surveys; and cross-section, transit and stadia, and plane-table topographical surveys. From the field-notes necessary computations are made and the surveys mapped.

Text-book: Raymond's *Plane Surveying.*

Reference-books: Baker's *Engineering Instruments;* Johnson's *Theory and Practice of Surveying;* Gannett's *Topographic Methods.*

ENGINEERING 4*c*. — Geodetic Surveying. — Field work of triangulation. — The use of astronomical instruments in Surveying and Navigation. Messrs. TURNER and ——.

This course is open to students who have passed satisfactorily in Course 4*a*. See note under Course 4*d*.

The course includes the methods of measuring base lines with special reference to the use of the steel tape, observing angles, adjusting angle observations, determining absolute position, adjusting triangulations, trigonometrical levelling, precise spirit levelling, and projecting maps, with field practice.

Text-book: Merriman's *Geodetic Surveying.*

Reference-books: U. S. Coast and Geodetic Survey Reports.

ENGINEERING 4*d*. — Railroad Engineering. — Survey, location, and construction of railroads. Field practice. Messrs. TURNER and ——.

This course is open to students who have passed satisfactorily in Course 4*a*.

The course includes a study of the principles necessary to enable the engineer to select a route for a railroad, to determine the necessary grades and curves, to solve the problems incident to the location of the line upon the ground, to compute the quantities in excavation and embankment, and finally to lay the track in place. The students survey a line two or three miles long, take topography, make a map location, and adjust the location to the ground, computing the cost of construction.

Text-book: Searles' *Field Engineering.*

Reference-books: Goodwin's *Railroad Engineering Field Book;* Searles' *Spiral;* Wellington's *Economic Theory of the Location of Railways.*

Courses 4*a*, 4*c*, and 4*d*, follow in sequence during the same summer; if all are taken, they can be counted as one and one-half courses towards the degree of A.B.

These courses are prescribed for students of Civil Engineering, and Course 4*a* is strongly recommended also for students of Mechanical and Electrical Engineering.

ENGINEERING 4*c*. — Construction and Maintenance of Common Roads. Mr. MCCLINTOCK.

Omitted in 1900–01.

This course cannot be counted towards the degree of A.B.

The course is intended to furnish a training in the construction and maintenance of ordinary highways. The location and survey of roads are treated in reference to the conditions governing such work. Foundations and selection of materials, the treatment of the road materials in construction, and the surface finish for various classes of traffic, receive careful attention. The various kinds of city pavements for heavy traffic are also considered. Students will be provided with opportunities for practical experience in the details of road building. The region in the vicinity of Cambridge affords excellent examples of the various methods practised in constructing streets and other highways.

Text-book: Byrne's *Treatise on Highway Construction.*

ENGINEERING 5*a*. — Applied Mechanics, including Elementary Kinetics. Professor HOLLIS and Mr. HUGHES.

This course is open to students who have passed satisfactorily in Courses 1*c* and 5*d* or their equivalents.

The course includes a short treatment of elementary Kinetics, followed by a somewhat extended course in the application of Statics and Kinetics to Engineering problems especially those relating to machinery. The

student will be expected to use both graphic and algebraic methods in the solution of problems.

Reference-books: Rankine's *Applied Mechanics;* Weisbach's *Mechanics of Engineering.*

ENGINEERING 5*b*. — Elementary Statics. — Graphical and Alegbraic Methods. Asst. Professor JOHNSON and Mr. MOYER.

This course is open to students who have passed satisfactorily in Courses 1*b* and 1*d*, or their equivalents.

The course is devoted to the study of Statics with special reference to the stability of structures and calculation of stresses. The structures treated include the common types of simple trusses, and masonry dams and arches.

The aim of the course is to give special prominence to graphical methods, but most of the problems will be solved algebraically as well as graphically, not only for the sake of practice in testing the correctness of work by comparing the results of the two independent solutions, but also that the relation between the two methods may be more perfectly understood.

ENGINEERING 5*c*. — Resistance of Materials. Professor HOLLIS.

This course is open to students who have passed satisfactorily in Courses 1*c* and 5*d*.

The course in Resistance of Materials is designed to give the student a comprehensive knowledge of the nature of all materials used in engineering construction, including the laws of their behavior under stress, both above and below the elastic limit. Special attention will be given to commercial tests and the relation of the test pieces to the members of engineering structures. The subject will be taught by means of the mathematical theory of elasticity of materials.

Reference-book: Burr's *Elasticity and Resistance of Materials of Engineering.*

ENGINEERING 5*d*. — Resistance of Materials. — Elementary Structural Design. Asst. Professor JOHNSON and Mr. MOYER.

This course is open to students who have passed satisfactorily in Course 5*b*.

After a brief exposition of the fundamental principles of Resistance of Materials, the work of the course is directed toward practice in the application of these principles in the simple problems constantly met in structural practice. Each student is required to solve a large number of problems in such a way as to aid in the formation of habits of speed and

accuracy in computation. These problems involve the design of wooden and steel beams, girders, footings, columns, wooden and combination roof-trusses, etc.

Reference-books: Johnson's *Materials of Construction;* Freitag's *Architectural Engineering;* steel manufacturers' handbooks.

ENGINEERING 6*a*. — Hydraulics and Hydraulic Motors — Flow of water in pipes. — Water wheels, turbines, and pressure engines. Mr. TURNER.

This course is open to students who take or have passed satisfactorily Course 5*a*, or Mathematics 4.

The first part of the course is devoted to the study of the general theory of Hydraulics, which is applicable to all branches of Hydraulic Engineering, including, among other things, the discussion of the laws governing the flow of water through orifices, over weirs, through tubes, and through pipes. The second part of the course is a study in the theory and practice of hydraulic motors. Visits are made to the Lowell and Holyoke water power plants.

Text-book: Merriman's *Hydraulics*.

Reference-books: Hamilton Smith's *Hydraulics;* Francis's *Lowell Hydraulic Experiments;* Bodmer's *Hydraulic Motors;* Bovey's *Hydraulics*.

ENGINEERING 6*c*. — Water Supply and Sanitary Engineering. Mr. ——.

This course is open to students who have passed satisfactorily in Course 6*a*. It cannot be counted towards the degree of A.B.

The considerations necessary for the complete design of water-supply systems by gravitation, pumping, and ground storage, from the survey of the water-shed to the delivery into the house, are taken up in detail and in accordance with the latest practice.

The effects of soil on water, and the importance of the geological character of the water-shed, as well as the conditions affecting the plan of storage and determining the supply, are all carefully considered.

The pollution and filtration of potable waters, as well as the whole subject of sanitary engineering, including the best methods of utilization and disposal of sewage, are treated in the light of the latest experience.

ENGINEERING 6*d*. — Canals, Rivers, and Irrigation. — Measurements of the flow of water. — Construction of irrigation works. Mr. TURNER.

This course is open to students who have passed satisfactorily in Course 6*a*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

The course includes the study of rain-fall, evaporation, flow-off from the catchment area, methods of measuring river discharges with field-work, the laws governing the flow in rivers, and methods of river improvement; the discussion of the theory of the flow in canals, and methods of constructing canals; the solution of the problems pertaining to irrigation engineering, such as the location and construction of canal head and regulating works, control and drainage works, and laterals and distributaries.

Reference-books: Fanning's *Water-Supply and Hydraulic Engineering;* F. H. Newell, in *U. S. Geological Survey Reports* and *Eleventh Census;* Humphrey and Abbott's *Mississippi River Experiments;* Wilson's *Irrigation Engineering.*

ENGINEERING 7*a*. — Bridges and Buildings. — Graphical Statics. — Details of iron and steel construction. Lectures and draughting. Asst. Professor JOHNSON.

This course is open to students who have passed satisfactorily in Courses 1*c* and 5*d* or their equivalents. It cannot be counted towards the degree of A.B.

The course is intended to give systematic training in the principles and methods involved in the economical design of iron and steel structures, such as bridges, roofs, and buildings.

The first part of the year is devoted to giving students a working knowledge of Graphical Statics, including the calculation of stresses from train-loads. Subsequently each student works out complete designs of typical structures of moderate size. Special attention is given to encouraging business-like methods of making and recording computations. Students make working drawings of their projects, taking no more time for such work than is needed for suitable presentation of their designs, and for some practice in expressing their ideas clearly and in detail by drawings.

Special problems which arise in connection with structures other than those designed in detail by the student are taken up in lectures and exercises. In this work, a prominent purpose is to train the student to make prompt and correct application of general principles already familiar to him.

Such knowledge of rolling-mill, shop, and erection practice as is needed for a clear understanding of the requirements of good design, is obtained from manufacturers' handbooks, from visits to neighboring bridge works, and to bridges and buildings in course of construction, and from lectures.

Text-book: Johnson, Bryan, and Turneaure's *Theory and Practice of Modern Framed Structures* (latest edition).

Reference-books: Merriman and Jacoby's *Roofs and Bridges;* Müller-Breslau's *Graphische Statik der Baukonstruktionen;* Johnson's *Materials of Construction;* steel manufacturers' handbooks.

ENGINEERING 8*a*. — Masonry and Foundations. Asst. Professor JOHNSON.

This course cannot be counted towards the degree of A.B.

In this course a study is made of the materials used in masonry and foundations, such as stone, brick, lime, cement, concrete, and timber, with reference to their physical properties, methods of preparation, cost, and their proper application to structures.

The different systems of foundations are also described and discussed with reference to their comparative merits and proper fields of application Some leading topics in this part of the course are piles, and pile-driving, coffer-dams, open caissons, pneumatic, and open crib work, etc.

The course includes also a brief description of the principal features of tunnelling.

Reference-books: Baker's *Masonry Construction;* Patton's *Foundations;* Drinker's *Tunnelling;* Johnson's *Materials of Construction;* Degrand et Résal, *Ponts en Maçonnerie.*

ENGINEERING 10*a*. — Chipping, Filing, and Fitting. — Use of hand-tools. — Fitting by hand. — Study of the metals in practical working. — Lectures and laboratory work. Asst. Professor BURKE.

See note under Course 10*e*.

ENGINEERING 10*b*. — Blacksmithing. — Use of tools. — Forging, welding, tool-dressing and tempering. Lectures and laboratory work. Asst. Professor BURKE.

See note under Course 10*e*.

ENGINEERING 10*c*. — Pattern Making and Foundry Practice. — Use of wood-working tools. — Casting in iron and alloys. — Lectures and laboratory work. Asst. Professor BURKE.

See note under Course 10*e*.

ENGINEERING 10*c*. — Machine Shop Practice. — Use of machine tools. — Construction of parts of machinery; finishing and assembling parts. — Lectures and laboratory work. Asst. Professor BURKE.

The courses in shopwork, Courses 10*a*, 10*b*, 10*c*, 10*e*, are prescribed for students of Mechanical and Electrical Engineering, and are strongly recommended for students of Civil Engineering.

These courses may be counted toward the degree of S.B. in General Science, but only when all four have been taken. They are rated for this purpose as the equivalent of three half-courses.

They cannot be counted towards the degree of A.B.

The courses in shopwork begin about June 10th and are completed in nine weeks. Courses 10*a* and 10*b* are given together during the first half of that period, and Courses 10*c* and 10*e* are given together during the second half of it.

Courses 10*c* and 10*e* will be given during term-time of 1900–01 also, but no student who is conditioned or deficient will be permitted to take them then. After the year 1900–01 these courses will be given only in the summer.

The courses in shopwork are conducted at present at the Cambridge Manual Training School where there are complete facilities for the purpose. The laboratory work is supplemented by lectures and by visits to the workshops within reach of Cambridge. The aim of the courses is not primarily to give students manual skill, but rather the practical knowledge of materials and of their methods of manufacture necessary for the design of effective and economical machinery.

ENGINEERING 11*a*. — Machinery and Boilers. — Description of the common types of engines and boilers. Asst. Professor MARKS.

This course is open to students who have passed satisfactorily in Course 3*a*. Wednesday afternoons must be kept free for visits of inspection.

The course is devoted mainly to a general study of the more common forms of steam machinery. The different types of steam boilers, their construction, setting, operation, and maintenance are described and discussed. The subject of fuels, solid, liquid, and gaseous, including the devices in use for their economical combustion, receives attention. This is followed by a study of the construction and operation of the various forms of stationary engines. Compounding, governing, counterbalancing, the action of the fly-wheel, and the effects of the inertia of the reciprocating parts are treated in an elementary manner. The methods of action of the common forms of valves and valve gears are explained.

Visits of inspection to various machinery plants in the neighborhood are arranged in order to make the students familiar with the machines described.

ENGINEERING 12*a*. — Efficiency and Economics of Engines and Boilers. Asst. Professor MARKS.

This course is open to students who have passed satisfactorily in Course 12*b*.

In this course heat engines are considered from the thermal standpoint. The sources of loss of efficiency in steam engines are individually analyzed and the methods of reducing the losses, by compounding, jacketing, superheating, and by other devices, are discussed. The effects of these losses on the cost of steam power and the considerations determining the choice of the type of steam engine to be used under any given conditions are treated. Gas and oil engines are similarly studied, and are compared with the steam engine. Other topics which are taken up include the theory and performance of air-compressing and refrigerating machines, and of steam turbines.

ENGINEERING 12*b*. — Elements of Thermodynamics. — Theory of Heat Engines. Asst. Professor MARKS.

This course is open to students who take or have passed satisfactorily in Course 13*a*. It cannot be counted towards the degree of A.B.

The course is devoted to a study of the laws governing the transformation of heat into work, and the application of these laws to the processes in air, gas, steam, and other heat engines.

ENGINEERING 12*c*. — Heating and Ventilation. Asst. Professor BURKE.

This course is open to students who have passed satisfactorily in Course 11*a*.

This course cannot be counted toward the degree of A.B.

The heating and ventilation of buildings receives the treatment necessary to supplement the instruction bearing on this topic given in other courses. Instruction in this course includes a consideration of the forms of hot-water and steam boilers, and hot air furnaces; the sizes and leads of pipes for the distribution of hot water, steam, and hot air; the positions and proportions of radiators, and the practical details of installing heating plants. The use of exhaust steam is fully treated. About half the time is devoted to the consideration of the principles and details of distributing air for heating and ventilation by mechanical means. Central heating plants are discussed briefly. Each student is required to design a heating and ventilating plant for a large building.

ENGINEERING 13*a*.—Engineering Laboratory.—Introductory course in experimental methods. Asst. Professor MARKS and Mr. HUGHES.

This course is open to students who take or have passed satisfactorily in Courses 5*a*, 6*a*, and 11*a*. It may be counted towards the degree of A.B. with the consent of the Chairman of the Division.

The principal objects of the course are to give instruction and practice in the measurement of some of the quantities with which the engineer has to deal, and to make the student acquainted practically with the methods and instruments used in carrying out engineering investigations.

The laboratory work includes the calibration of various instruments, such as steam engine indicators, transmission and absorption dynamometers, and pressure gages; the determination of the efficiencies of hoisting gears, steam boilers, steam engines, pumps, gas engines and water wheels; the investigation of the efficiency of the transmission of power by ropes and belts; the measurement of the friction of journals and of the flow of water through orifices and over weirs; the testing of the strength of wrought iron, steel, cast iron, wood, stone, brick and cement under tension, compression, bending, impact, and torsion. Practice is also given in flue gas analysis, in the use of steam calorimeters, and in valve setting.

ENGINEERING 13*b*. — Engineering Laboratory. — Advanced course in Experimental Engineering. Asst. Professor MARKS.

This course is open to students who have passed satisfactorily in Course 13*a*, and are taking Course 12*a*. It cannot be counted towards the degree of A.B.

The work in this course consists of a series of investigations carried out by all the students and of a research on some special subject which may form the basis of, or may supplement the student's thesis. The regular investigations include complete tests of a boiler, steam engines, gas engines, a hot air engine, an air compressor, a blower, an injector, governors and other machines. Some investigations are also made on the transmission and radiation of heat, on the strength of materials, on lubricants and fuels, and the transmission of power. Tests of power plants will be made as opportunity offers.

ENGINEERING 14*a*. — Machine Design (introductory course). — Designing the parts of machinery. — Methods of proportioning the parts for strength and effect. Mr. MOSES.

This course is open to students who have passed satisfactorily in Course 3*d*, and who take or have taken Courses 5*a* and 11*a*. It may be counted towards the degree of A.B. with the consent of the chairman of the Division.

This course is intended to give practice in the design of simple machine details and some knowledge of the application of the principles of mechanics. Complete working drawings of machines and their details are made during the year; but the students are required to design a great

many pieces of which only freehand sketches are kept. All of the latter work is done in note-books, which are carefully examined by the instructor, in order that habits of neatness and system as well as accuracy may be learned.

Text-book: Low and Bevis's *Machine Design*.

Reference-books: Reuleaux' *Constructor;* Kent's *Mechanical Engineer's Handbook*.

ENGINEERING 14*b*. — Machine Design (second course). — Completed designs of machinery. Professor HOLLIS and Mr. KENNEDY.

This course is open to students who have passed satisfactorily in Course 14*a*. It cannot be counted towards the degree of A.B.

The designs of entire machines are undertaken in this course with instruction in the details of the steam engine and boiler. It is expected that every student will complete the working drawings for all parts of a steam engine and, if time permits, of a steam boiler. Reference is freely made to the books and drawings in the library, and the student is required to study out the designs himself with only such aid from the instructor as may be needed to insure reasonable progress.

ENGINEERING 15*a*. — Marine Engines and Boilers. Professor HOLLIS.

This course is open to students who have passed satisfactorily in Course 14*a*. It cannot be counted towards the degree of A.B.

This course is intended mainly as an alternative for Course 14*b* and it will be similar to it, relating however to a different class of problems. There will be a series of lectures on marine machinery and the elements of ship construction. Each student will be expected to design the engines and boilers for a given ship; and, if time permits, he will have the opportunity of making the plans of an entire ship.

ENGINEERING 16*a*. — Industrial Applications of Electricity, with special reference to Dynamo-Electric Machinery. Lectures and laboratory work. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily in Course 1*c* or its equivalent, and in Physics *C* or Physics 1.

The lectures begin with a review of the laws governing the flow of electric currents, the laws of electro-magnetic induction, and the magnetic circuit. These laws are then applied in the study of the more important

types of apparatus for the measurement, generation, transformation, and utilization of electrical energy; including arc and incandescent lamps, primary and secondary batteries, direct-current generators and motors, alternating current generators, synchronous alternating current motors, induction motors, and rotary converters.

The work in the laboratory follows the same general outline as the lectures. Beginning with a few elemetary measurements in electricity and magnetism, the student takes up electric light photometry and storage battery tests, and then the experimental study of the above mentioned types of electrical machinery.

The treatment of these subjects, in both lectures and laboratory, is of necessity elementary, but sufficient to give the student a general familiarity with the most important characteristics and the range of usefulness of each type of apparatus.

Reference-books: S. P. Thompson's *Elementary Lessons in Electricity and Magnetism;* S. P. Thompson's *Dynamo-Electric Machinery;* Jackson's *Electro-magnet and Dynamo Construction;* Ewing's *Magnetic Properties of Iron and other Metals;* Houston and Kennelly's *Electro-Dynamic Machinery;* Slingo and Brooker's *Electrical Engineering.*

ENGINEERING 17*a*. — The Electrical Transmission and Distribution of Power. Lectures, laboratory work, and visits. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily in Course 16*a*.

The lectures begin with a review of the several means of utilizing electrical energy and then take up the discussion of the suitability to these uses of each of the several systems of electrical distribution.

The following cases are considered, with descriptions of typical plants: electric lighting from central stations and from isolated plants; power distribution for street railways, suburban and main lines of steam railroads, factories, mills, printing machinery, elevators, and for electro-metallurgy.

As the student is assumed to have a general knowledge of the more important forms of apparatus employed for the generation and utilization of electrical energy, the course deals largely with the transmitting and distributing systems, including the controlling, regulating, and protective devices. Special attention is given to polyphase alternating current systems.

Visits are made to several of the numerous interesting plants in the vicinity of Boston, and in each case a written report is made, carefully describing the system used and any features of special interest.

Reference Books: Bell's *Electric Power Transmission;* Abbott's *Electrical Transmission of Energy;* Oudin's *Standard Polyphase Systems;* Crocker's *Electric Lighting.*

ENGINEERING 16*d*. — Dynamo Design. Asst. Professor ADAMS.

This course is open to students who take or have taken Course 16*e*.

It is intended primarily for fourth year students in Electrical Engineering and cannot be counted towards the degree of A.B.

The work is carried on in the draughting room with occasional lectures on the theory of design. Each student is expected to make complete designs of one direct-current constant potential generator, one alternating current generator, one alternating current transformer, and one induction motor.

All electrical and magnetic dimensions are worked out and sketches made on section paper, and in the case of one of the machines designed by each student, complete large scale drawings are made.

Considerable reading is required.

Reference-books: Kapp's *Elektromechanische Konstruktionen;* Fischer-Hinnen's *Continuous Current Dynamos;* Parshall and Hobart's *Armature Winding;* Arnold's *Ankerwicklungen und Ankerkonstruktionen;* and numerous articles in the electrical periodicals.

ENGINEERING 16*e*. — Alternating Currents and Alternating Current Machinery. — Theory and testing. Asst. Professor ADAMS and Mr. WHITING.

This course is open to students who have passed satisfactorily in Course 16*a* or Physics 4.

The lectures begin with the theory of alternating currents including the effects of inductance, capacity, and frequency, and then take up the study of machinery for the generation, measurement, transformation, transmission, and utilization of such currents.

In the laboratory the first series of experiments is designed to familiarize the student with the effects of inductance and capacity in alternating current circuits, with the methods of measuring these quantities and with the magnitudes of their practical units. Then follow experiments on alternators, transformers, alternating current motors, and rotary converters; some of the more important of which are: — the taking of characteristic, efficiency, saturation and synchronous impedance curves of alternators; measurements of armature inductance and armature reaction; observations of the operation of synchronous motors with curves showing the limit of stability and the variation of current with excitation; the taking of speed characteristic, efficiency, power factor, and other curves from induction motors; experiments showing the influence of armature

resistance and inductance upon the speed characteristics and outputs of induction motors; regulation and efficiency of transformers with separation of losses; instantaneous current and E. M. F. curves from transformers and alternators; experiments on the efficiency and stability of, and commutation in, rotary converters.

Reference-books: C. P. Steinmetz's *Alternating Current Phenomena;* Gisbert Kapp's *Electric Transmission of Energy;* Gisbert Kapp's *Transformers;* D. C. Jackson's *Alternating Currents and Alternating Current Machinery;* Franklin and Williamson's *Alternating Currents;* Oudin's *Standard Polyphase Systems;* and S. P. Thompson's *Polyphase Electric Currents.*

ENGINEERING 16*f*. — Electrical Engineering Laboratory — Electric Light Photometry; Storage Batteries; Insulating Materials; Cable Testing. Mr. WHITING.

This course is open only to fourth-year students in Electrical Engineering. It cannot be counted towards the degree of A.B.

The work is given in periods of about three hours each at such times as are free from conflict with other courses. The students work singly or in pairs, and are required to arrange for themselves the details of each test. Occasional conferences are given.

The course deals with a variety of special tests of which the following are examples: in photometry, life and efficiency tests of incandescent lamps; in battery work, capacity under varying rates of discharge; in insulation work, dielectric strength of rubber-covered wires; in cable-testing, the common measurements of insulation, capacity, and fault location. Apparatus in commercial use outside of the laboratory is tested from time to time as opportunity offers.

ENGINEERING 18*a*. — Metallurgy. — Manufacture and physical properties of the metals used in engineering construction. — Lectures on the practical working of iron and steel. Asst. Professor BURKE.

This course is intended primarily for students of Engineering, but it may be taken by others. It cannot be counted towards the degree of A.B.

The instruction relates mainly to iron and steel, and is intended to supply the student with a thorough knowledge of the metals he will have to use in his professional work. It consists of a full course of lectures on the manufacture of iron and steel, together with their handling in the foundry, forge shops, and rolling mill. Numerous specimens, showing various stages of the processes treated, are used, and, whenever possible, visits are made to the workshops within reach of Cambridge.

ENGINEERING 21. — Conference on Engineering subjects. — During the first half-year, all students of engineering meet together; during the second half-year students of Civil, Mechanical, and Electrical Engineering meet in separate sections.

Course 21 is part of the required work of fourth-year students of Engineering, and will not be counted for other students towards the degree of S.B. It cannot be counted towards the degree of A.B.

The course is conducted mainly by students, and deals with current problems in Engineering, referring freely to transactions of engineering societies and to periodicals.

ENGINEERING 22. — Contracts and Specifications. — Fifteen lectures on the principles of Common Law as applied to contracts. Asst. Professor WESTENGARD.

Course 22[2] is part of the required work of fourth-year students of Engineering, Architecture, and Landscape Architecture, and will not be counted for other students towards the degree of S.B. It cannot be counted towards the degree of A.B.

It consists of about fifteen lectures on law, with practice in drawing up contracts and specifications for various projects.

Primarily for Graduates.

COURSES OF RESEARCH.

At present only one research course is formally offered, but opportunity and guidance will be provided for competent students wishing to pursue other lines of research.

ENGINEERING 20*a*. — Investigations in connection with alternating current machinery. Asst. Professor ADAMS.

This course is intended primarily for graduate students who are candidates for the degree of S.M. in Engineering, but may be taken by others well prepared.

It may count for one, two, or more full courses, but it is not deemed advisable to undertake any research course unless the time of at least two full courses can be devoted thereto.

The work consists, first of extensive reading and the preparation of a bibliography of the subject, by which the student is made familiar with all the important work done in the same line before; next the planning and performance of the experimental part of the investigation; and finally the preparation of a thesis on the subject, including a full account of the work done and a complete discussion of all the results.

Thesis.

Every thesis should consist of a complete investigation or design, containing, where possible, the results of personal and independent observation, and so limited in scope as to be capable of completion before the first of June.

The subject of the thesis should be selected as early as possible in the senior year. It must be submitted to the Chairman of the Division before December 1, in order that it may have consideration at a meeting of the Division shortly after that date.

The Division will suggest the instructor under whose guidance the work should be prosecuted. After approval by the Division the subjects selected for the thesis, with the names of the investigators, will be posted in the Engineering Library for the remainder of the year.

Reports of progress and of the methods of investigation will be made and discussed in Engineering 21 during the second half-year. Students will be informed by the Chairman when they are to present these reports.

The completed theses are to be presented before the first of June to the instructor under whose direction it has been prepared, and the student may be required to stand an examination on it or to read it at a meeting of the Division and class.

Attention must be paid to clear English and to a concise, accurate presentation of the subject. The theses will be bound and deposited in the Engineering Library for future reference.

All theses must be written (preferable type written) on paper of dimensions $8'' \times 10\frac{1}{2}''$, so that they may have uniform binding. Drawings and sketches necessary for explanation of the text must be folded to the size of the manuscript with an edge left for binding.

PHYSICS.

Physics *B*. — Experimental Physics. Professor Hall and an assistant.

The laboratory exercises of Course *B* will be given in the morning hours, in most cases from 9 to 11 or from 11 to 1, on the last three days of the week.

Course *B* is substantially equivalent to the second alternative in the Elementary Physical Science of the requirements for admission. It is open to students who have not passed in this requisition or taken in College any Course in Experimental Physics.

The object of this course is to enable every student to obtain practical acquaintance with laboratory methods of work and with those elementary facts and laws which are the foundation of the science of Physics. It is

for those who have done little or no laboratory work in Physics before coming to College, and is the natural introduction to Courses *C* and 1. Students are advised to take it in the Freshman or the Sophomore year. The book used is Hall and Bergen's *Text-book of Physics*, Holt & Co.

PHYSICS *C*. — Experimental Physics. — Mechanics, Sound, Light, Magnetism, and Electricity. Asst. Professor SABINE and an assistant.

Course *C* is substantially equivalent to the Advanced Physics of the requirements for admission. It is intended for those who wish to give especial attention to methods of physical measurement in preparation for higher courses in Physics, Chemistry, or Engineering. The course is open to those students only who have presented Elementary Laboratory Physics for admission, or have taken Physics *B* or its equivalent.

The manual used as a guide in the laboratory work is Sabine's *Laboratory Course in Physics*, Ginn & Co.

PHYSICS 1. — General Descriptive Physics. Professor HALL and an assistant.

Course 1 is intended for students who wish to become acquainted with a wide range of physical phenomena and with the means for exhibiting and applying such phenomena. It is regularly open to students who have taken Course *B* or who have passed in the second alternative of the Elementary Physical Science of the admission requirements, but may be taken by others who satisfy the instructor of their fitness to profit by the course.

Course 1 is naturally taken by students who do not intend to take any higher course in Physics.

Hastings and Beach's *General Physics*, Ginn & Co., will be used as a text-book.

PHYSICS 2. — Theory of the Microscope, its accessories, and other optical apparatus used in the study of organisms. Asst. Professor SABINE.

Course 2 is designed for students making a specialty of Zoölogy or Botany, and is open to those who have taken Zoölogy 2, or Botany 2, or can otherwise satisfy the instructor of their fitness to profit by the course. It is not intended for students specializing in Physics.

PHYSICS 3. — Electrostatics, Electrokinematics and parts of Electromagnetism. Professor B. O. PEIRCE and an assistant.

Course 3 is adapted to students who take or have taken Mathematics 2 or its equivalent, and should be preceded by Course *C* or 1.

The course consists of a lecture or recitation every Tuesday, with from six to eight hours of laboratory work per week. In the laboratory the student is expected to learn to make accurate absolute or relative measurements of current strength, resistance, electromotive force, quantity, and capacity. In the second half of the year such a knowledge of the principles of the Differential and Integral Calculus will be assumed as students who are then taking Mathematics 2 should have.

Students who elect this course are asked to provide themselves with S. P. Thompson's *Lessons in Electricity and Magnetism*, Part 2 of the *Physical Laboratory Notes of the Massachusetts Institute of Technology*, Day's *Examples in Electricity and Magnetism*, and a pamphlet published by the University containing a description of certain preliminary experiments in Magnetism. References will be made to other books to be found reserved in Gore Hall.

PHYSICS 4. — Electrodynamics, Magnetism, and Electromagnetism. Professor TROWBRIDGE, Asst. Professor SABINE, and Dr. THEODORE LYMAN.

Course 4 is intended for students who have taken Mathematics 2, or its equivalent, and Physics 3.

This course consists of lectures, recitations and laboratory work. During the first half of the year, the subject of Magnetism and Electromagnetism is treated in lectures with copious references to Wiedmann's *Galvanismus*, and to the unmathematical portions of Maxwell's *Electricity*. During the second half of the year the student is expected to employ the principles of the Differential and Integral Calculus. Some of the mathematical portions of Maxwell's and Mascart's treatises will be referred to, and Steinmetz's treatise on *Theory and Calculation of Alternating Current Phenomena*, and Ewing's treatise on *Magnetic Induction in Iron and Other Metals* will be used as text-books.

The laboratory work embraces the standard tests of the magnetic quality of iron, the various methods of measuring coefficients of self induction and mutual induction with reversed and with rapidly alternating currents, and other experiments with rapidly alternating currents of low intensity.

Courses 3 and 4 together are intended to cover the subjects of Magnetism and Electricity, and to give a suitable foundation for students who propose to study Electrical Engineering or the higher branches of Electrical Science.

CHEMISTRY.

CHEMISTRY 1. — Descriptive Inorganic Chemistry. Professor JACKSON, Mr. CALHANE, and six assistants.

Course 1 may be taken with Pysics *B* although in the same examination group.

In this course each student has each week two lectures on Monday and Friday at 12 in Boylston 7, and either four hours of laboratory work or, more commonly, two hours of laboratory work and one of recitation. For laboratory and recitation work there are two divisions (to avoid conflicts), — the first on Tuesday and Thursday from 1.30 to 3.30, the second on Wednesday and Friday from 2.30 to 4.30. The recitations (one hour) come at 1.30 on Thursday for the first division, at 2.30 on Friday for the second, and when they are held no laboratory work is required on these days. Recitations in Boylston 7; laboratory exercises in Boylston 13 or A.

No previous chemical training is required for Chemistry 1, but more advantage will be gained from this course if the student has some knowledge of the general principles of chemistry, such as that given in Course *B*, or in the chemistry required for entrance to College. The course deals with the preparation, properties, and uses of the more important elements and inorganic compounds. The lectures are illustrated by experiments and diagrams, and in the laboratory those experiments are performed which are not well adapted to the lecture-room. There is no text-book. A pamphlet entitled *Laboratory Experiments in Chemistry 1* is essential; another, *Synopsis of Lectures in Chemistry 1*, is useful, but not essential.

The course trains the memory, the powers of inductive reasoning, the faculties of observation, and of manipulation. It gives a knowledge of inorganic chemistry sufficient for all the ordinary uses of life, even for men engaged in a scientific profession. It carries systematic instruction in inorganic chemistry as far as is desirable; if a man wishes a fuller knowledge of the subject, he can obtain it by study of the larger text-books much more advantageously than by an additional course of lectures.

This is one of the courses required of all students in the Scientific School (except those in Architecture) and for admission to the Medical School. It is also an essential preparation for all the courses which follow.

CHEMISTRY 2. — Organic Chemistry (Elementary Course). Dr. TORREY.

In this course a student has three lectures a week during the first half-year. The object is to give a general idea of the chemistry of the

compounds of carbon. With Course 1 it presents a general survey of the facts of chemistry. It serves as a preparation for the much more extended course on the same subject (Course 5), and students who can afford the time are strongly advised to use it in this way, but it is not required for Chemistry 5. It is intended, also, for students of Biology, and for those who are preparing to enter the Medical School, and the portions of organic chemistry treated will be selected with a special view to the needs of such students.

This course (or Course 5) is required of all those who elect Course 8. Of Courses 2^1 and 5, only one can be counted for Honors in Chemistry.

CHEMISTRY 3. — Qualitative Analysis. Asst. Professor SANGER and three assistants.

To be admitted to this course the student must have passed Chemistry 1, or have taken a course of descriptive chemistry equivalent to it.

The amount of laboratory work given in this course will occupy an average worker nine hours each week, three of which must come at the hours given in the programme. During the last two years the class was so large that a second division at different hours was arranged for the required three hours of laboratory work, but not for the lectures. The remaining six (or more) hours can come at any time most convenient to the student. At the three required hours the exercises occasionally consist of lectures instead of laboratory work. The text-book is Hill's *Lecture Notes on Qualitative Analysis.*

This course trains the student to draw correct inferences in regard to the compositon of substances from a carefully arranged sequence of experiments. It has therefore great educational value, and is also an essential preparation for the more advanced chemical courses. After the analysis of the large number of substances required in this course, the student has a training in qualitative analysis sufficient for all purposes.

It is required for admission to the Harvard Medical School, and students who pass satisfactorily in Chemistry 1 and 3 are admitted without examination in chemistry. It also forms part of the Scientific School courses in Mining and Metallurgy, Geology, Biology, and Anatomy and Physiology.

CHEMISTRY 4. — Quantitative Analysis. Asst. Professor SANGER and an assistant.

To enter this course the student must have passed in Chemistry 1 and 3, or courses in the same subject equivalent to these. Students are allowed, however, to take Chemistry 3 and 4 together in the same year. The work in this course is expected to occupy nine or more hours each week, all in the laboratory; three of these hours must come at the times mentioned

in the programme, the remaining work can be done at any time most convenient to the student. The regular hours are occasionally occupied by lectures.

The object of this course is to teach the methods of determining the amounts of each constituent in a substance. It gives a general survey of the more important methods, both gravimetric and volumetric. It has less general educational value than many of the other chemical courses, but is the foundation of all advanced chemical work, and therefore essential to those going further in the subject. It also trains the student especially in skill, care, and accuracy, and would therefore be of great value, though not essential, to those who intend to study medicine or certain branches of natural history.

The laboratory for quantitative analysis was remodelled lately, and is supplied with filter-pumps, steam evaporators, electrolytic apparatus, and other modern appliances. The number of balances in the adjoining room is so large that each is assigned to not more than four men.

Chemistry 5. — The Carbon Compounds. Professor H. B. Hill and an assistant.

To enter this course the student must have passed Chemistry 1, or an equivalent course in the same subject; but, although students who have studied only Chemistry 1 are admitted, it is advisable to have a fuller knowledge of Chemistry (3 and 4) before entering this course. Chemistry 2 is intended to prepare students for this course and is strongly recommended for this purpose, although it is not essential. The hours named in the programme are occupied by lectures (three each week), and there is required also an amount of work in the laboratory which occupies six hours with an average man. In the lectures a systematic course of organic chemistry is given treating the subject principally from the theoretical side, for, although the applications of the science are described briefly, most of the time is devoted to the description of the preparation and properties of the general groups, and to the elucidation of the structure of the molecules of organic substances, with the methods by which problems relating to the organic constitution are solved. In the laboratory the time is devoted to the methods of organic analysis, and to the preparation of organic compounds. As a general rule the laboratory work of each man is different from that of his fellows, and may be varied to suit his needs or intentions. Students are sometimes allowed to count Chemistry 5 as two courses by giving a larger amount of time to laboratory work, but to do this the consent of the instructor and of the Administrative Board must be obtained. A reading knowledge of German is useful, but not required in this course.

This course, in addition to cultivating the faculties trained by the other chemical courses, gives practice in reasoning, and in the correlation of a large number of facts by referring them to general principles. It gives a comprehensive knowledge of organic chemistry, and takes the student as far as is worth while by lectures. Students who wish to pursue the subject further would devote themselves to special lines of study in the chemical journals. It is the essential preparation for research in organic chemistry, and is earnestly recommended to all who intend to make a speciality of chemistry. Candidates for Honors in Chemistry and for the Doctor's degree must pass this course. It is useful but not essential to those who intend to study medicine or biology.

The laboratory occupied by the students in Chemistry 5 is fitted with gas, water, steam, and a filter-pump at each desk. The hoods are large and powerful; a sunlight table is provided for work which needs this agent; and attached to the laboratory are a balance-room, a room with the two combustion furnaces, and a room for sealed tube work.

CHEMISTRY 6. — Physical Chemistry. Asst. Professor RICHARDS and Mr. HEIMROD.

The students taking this course are required to have passed in the following courses or their equivalents: Physics 1 or *C*, Mathematics *A* and *B*, Mathematics *F*, or Engineering 1*b* and 1*d*, Chemistry 4 and 8. A knowledge of Calculus (Mathematics 2 or Engineering 1*c*) is also very desirable.

Students omitting the laboratory work count Chemistry 6 as a half course. In this case Chemistry 4 is not necessary as a preparation.

In the lectures a complete survey of the subject is given, including the relations of mass and volume, phase relations, thermo-chemistry and chemical thermodynamics, chemistry of solutions and the dissociation hypothesis, electro-chemistry, and optical chemistry. The laboratory work, which will be arranged to occupy an average man six hours a week, consists of the study of physico-chemical methods as related to the subject-matter of the lectures, and includes among similar subjects the determination of the specific gravity of solids, liquids, vapors, and gases; calorimetry; the use of the spectroscope and the refractometer; boiling and freezing point determinations; and the study of the conductivity of electrolytes.

Text-book: Ostwald, *Physico-Chemical Measurements* (translated by Walker).

Books of Reference: Nernst, *Theoretische Chemie*, 1898; Ostwald, *Grundriss* and *Lehrbuch;* Le Blanc, *Electrochemistry* (translanted by Whitney); Lübke, *Electrochemie;* Haber, *Electrochemie:* Van't Hoff,

Lectures on Physical and Theoretical Chemistry (translated by Lehfeldt); Bancroft, *The Phase Rule;* Kohlrausch and Holborn, *Leitvermögen der Electrolyte.*

A reading knowledge of German is almost essential in this course.

In addition to the educational value found in the other chemical courses, this gives a certain amount of mathematical practice. It is essential for those who take the research course in physical chemistry, and is recommended to all advanced students in Chemistry. Candidates for Honors in Chemistry and for the Doctor's degree must pass this course.

Two laboratories, a dark room, and a small workshop are devoted to this subject. Water, steam, gas at constant pressure and both alternating and direct current electricity are available.

Chemistry 7. — Electrochemistry. Mr. Heimrod.

This course is open to students who have finished the first half of Course 6, or who have an equivalent preparation in descriptive and theoretical chemistry, the principles of physics, and the elements of physical chemistry. An elementary knowledge of the calculus, although not essential, is urgently recommended.

The lectures will present (1) the law and modern theories of electrochemistry, (2) the applications of electrochemistry in pure science, especially in analytical chemistry and organic preparations, (3) the application of electrochemistry to technical processes. The theory will be treated from the standpoint of thermodynamics and also with particular reference to the hypothesis of electrolytic dissociation.

Such reading will be required as will acquaint the student with the most recent developments of the subject, but its nature will be adjusted, as far as possible, to individual needs and tastes. This work will be tested by conferences and written reports, or by papers read before the Conference in Physical Chemistry.

This course is recommended to all who intend to engage in the further study of theoretical and physical chemistry, or in manufacturing chemistry.

Chemistry 8. — History of Chemistry and Chemical Theory. Asst. Professor Richards.

This course is required for Honors in Chemistry and for Chemistry 6. It can be taken only by those who have passed in Chemistry 1 and 2, or are taking 5. It consists of lectures upon the history of the science, tracing it from the earliest times to the present day, and dwelling especially on the modern chemical theories. This course should be taken by all who intend to make an extended study of chemistry, for the very elementary knowledge of the theory of chemistry given in Chemistry *B* and 1 is

inadequate for even a moderately advanced student. Chemistry 8 is essentially non-mathematical, although it demands a knowledge of arithmetic and of simple equations. It serves as an introduction to Chemistry 6, where modern theories are discussed in greater detail.

No text-book is required, but the following works are used as books of reference: J. Walker, *Introduction to Physical Chemistry:* E. von Meyer, *History of Chemistry* (translated by McGowan); Ostwald, *Grundriss* and *Scientific Foundations of Analytical Chemistry* (translated by Walker); Lothar Meyer, *Grundzüge*, and *Modern Theories* (translated by Bedson and Williams); Würtz, *Atomic Theory;* Le Blanc, *Electrochemistry* (translated by Whitney); Venable, *History of Chemistry*, and *Development of the Periodic Law;* Nernst, *Theoretische Chemie.*

CHEMISTRY 9. — Advanced Quantitative Analysis. Asst. Professor RICHARDS, and an assistant.

To be admitted to this course students must have passed with credit Chemistry 4, or an equivalent course on the same subject. Chemistry 8 also is desirable, but not necessary.

The object of the course is to give the student a fuller and more systematic knowledge of inorganic analysis than is possible in Chemistry 4. At first the various processes and operations are discussed in detail, and subsequently the whole field of the more common elements is surveyed. Emphasis is laid upon the influence of modern theories on the practice of quantitative analysis. The laboratory work, which occupies less time than is required for Chemistry 4, is concerned with typical methods of a complex nature; towards the close of the course it may be varied to suit special needs or desires on the part of the student.

Books of reference: V. Muller and Kiliani's *Quantitative Analysis;* Ostwald's *Scientific Foundations of Analytical Chemistry;* Fresenius' *Quantitative Analysis;* Talbot's *Quantitative Analysis;* Sutton's *Volumetric Analysis.*

CHEMISTRY 10. — Gas Analysis. Asst. Professor RICHARDS, and an assistant.

This course should follow Chemistry 9, but it may be taken with Chemistry 4 if the student has attained Grade *B* in the mid-year examination in that course.

The laboratory work in Gas Analysis is expected to require at least nine hours a week. It deals with the density of gases, with the volumetric and barometric methods of determining the composition of illuminating and other gases, and with many modern practical applications of gasometric apparatus. Hempel's and Winkler's books, as well as original articles, are used as references.

Chemistry 9 and 10 are intended for those who mean to make a specialty of chemistry, and, while useful for all of these, are essential for those who mean to take the course in inorganic research.

Research Courses.

A mastery of the following subjects is necessary for all who take research courses: Descriptive Chemistry (Chemistry 1), Organic Chemistry (Chemistry 2), Mineralogy (Mineralogy 2), Qualitative Analysis (Chemistry 3), Quantitative Analysis (Chemistry 4), and Theoretical Chemistry (Chemistry 8). In addition to this general chemical training, special preparation must be made for the research course taken, as follows: For Inorganic Chemistry, Chemistry 9 and 10; for Organic Chemistry, Chemistry 5; for Physical Chemistry, Chemistry 6. Equivalent courses in the same subjects are accepted in place of the elective studies in Harvard College.

Each student is earnestly advised to pursue as many of these special studies (9, 10, 5, and 6) as possible, in addition to those necessary as direct preparation for his special line of research, since an organic chemist, for example, will take a broader view of the subject, and thus make a better specialist, if he has some knowledge of advanced quantitative analysis and physical chemistry. Courses 5 and 6 (or their equivalent courses taken elsewhere) are required of all candidates for the Doctor's degree. To obtain the greatest advantage from a research course, the student should devote all his time to it. If this is impossible, he should not undertake one of these courses unless he can give at least half his time to it. No one is allowed to take two research courses in a single year. In every case the professor must be consulted before the course is taken. A reading knowledge of German and French is required for these courses.

Instruction is offered in the following special lines of research:

20*a*. Inorganic Chemistry by Asst. Professor Richards.
20*b*. Organic Chemistry by Professor Jackson.
20*c*. Organic Chemistry by Professor Hill.
20*d*. Physical Chemistry by Asst. Professor Richards.
20*e*. Applied Chemistry by Asst. Professor Sanger.

Arrangements will be made, if possible, to give instruction to students wishing to pursue lines of research not included in these special departments.

In order to give an idea of the nature and scope of the work, a list of the papers of the last five years is given under Chemistry 20*a*, 20*b* and *c*, and 20*d*. As Chemistry 20*e* was established this year, no papers have as yet been published from this course.

CHEMISTRY 20*a*. — Inorganic Chemistry. Asst. Professor RICHARDS.

The work in this course has consisted heretofore in (1) The revision of atomic weights; (2) The preparation of new compounds; (3) The separation and study of the salts of the rare elements; (4) Study of the methods of quantitative analysis. Each student selects from these lines of work that for which he is best fitted.

The laboratory for research in Inorganic Chemistry provides ample desk-room for each student, and is furnished with gas, water, steam, and filter pumps. Excellent facilities are provided for electrolytic work. For the revision of atomic weights there are special balances, and provision is made for the most refined and delicate work.

CHEMISTRY 20*b*, or 20*c*. — Organic Chemistry. Professor JACKSON, or Professor HILL.

The courses of the two professors are entirely distinct, and the student must select the course which he proposes to follow. The student works in the laboratory for organic chemistry described under Chemistry 5 (see p. ŦŦI). The desk-room allowed each man is ample, and the facilities for research are of the best.

CHEMISTRY 20*d*. — Physical Chemistry. Asst. Professor RICHARDS.

The Laboratory (described on page 000 under Course 6) is provided with the usual instruments of research in physical chemistry; and the work in this course may take any one of the following directions: (1) Electrochemistry; (2) Thermochemistry; (3) Spectroscopy; (4) Photochemistry; (5) Problems in equilibrium. Work in other lines than these could also be arranged, if desired. Each student selects from these the work for which he is best fitted. A knowledge of calculus (Mathematics 2 or Engineering 1*f*) and of Thermodynamics (Physics 6) is essential for most of these lines of work; a more advanced knowledge of mathematics and physics is desirable. Work in Boylston Hall may be advantageously combined with work in the admirably equipped Jefferson Physical Laboratory.

AGRICULTURAL CHEMISTRY.*

AGRICULTURAL CHEMISTRY. Lectures, Reading, Laboratory. Given at the Bussey Institution. Professor STORER.

This course treats of the following: —

Soil, air and water in their relations to plants. The food of plants. Chemical principles of tillage, irrigation. Manures and fertilizers.

* Given at the Bussey Institution.

BOTANY.

Botany 1. — General introductory course. Dr. True and Mr. Olive.

This course is required as an introduction to Courses 3, 4, and 5. It is intended for beginners and for those who wish to get a comprehensive view of the subject. It is open to First-year men and may be taken with advantage in the same year with Zoölogy 1.

The lectures cover the principal topics in General Botany, the structure, functions, and habits, especially of flowering plants, their classification, distribution, adaptations, and uses. The relations of the subject to evolution are presented, and, as far as possible, illustrated by preparations and living specimens. The plants cultivated at the Botanic Garden of the University are at the service of this elective course, and afford ample material for demonstrations. These resources are supplemented by the specimens in the Botanical Museum. The practical work in this course is conducted in small sections under the direct supervision of trained laboratory assistants, who endeavor to familiarize every student with the principles underlying the identification and description of species, and the preservation of botanical specimens.

For laboratory practice, four hours a week are expected. The hours may be selected by the student from the following schedule: —

Sect. 1. *Monday and Wednesday, from 9 to 11.*
Sect. 2. *Monday and Wednesday, from 11 to 1.*
Sect. 3. *Monday and Wednesday, from 1.30 to 3.30.*
Sect. 4. *Tuesday and Thursday, from 11 to 1.*
Sect. 5. *Tuesday and Thursday, from 1.30 to 3.30.*

Botany 2. — Morphology of Plants. Asst. Professor Thaxter.

This course cannot be taken separately from Zoölogy 2 without the consent of the instructor.

The aim of Botany 2 and Zoölogy 2 is to afford the necessary elementary training for those who desire to continue the study of some branch of Biology and should be taken preferably in the second year, as a preparation for the more advanced electives. Botany 1 is not required as a preparation for Botany 2, but should if possible precede it.

The course is given on Mondays, Wednesdays, and Fridays during the first half-year, after which it is succeeded by Zoölogy 2. Two or three lectures are given every week in addition to which a minimum of six hours of laboratory work is required to be performed on the days above specified, on each of which students should, if possible, arrange to spend two

consecutive hours. The laboratory work involves the constant use of the compound microscope, in connection with which are taught the simpler methods of sectioning and staining microscopic preparations, twenty-four of which are required to be handed in for examination together with the laboratory note-books at the end of the course : while the objects examined and drawn are designed to illustrate the morphology and reproduction of certain more important types throughout the vegetable kingdom. The lectures embrace a comprehensive review of the morphology and development of plants and their types of reproduction, special attention being given to the lower plants or Thallophytes, including the Bacteria.

Botany 3. — Morphology, Histology (with special reference to the technique of the microscope), and Physiology of Flowering Plants. Laboratory practice with lectures and demonstrations. Dr. True and Messrs. Olive and Ames.

Course 3 is open to those only who have taken Course 1.

The first half-year is devoted to the study of the microscopic structure of Flowering plants and Ferns, and their allies. As far as is possible, a comparative study is made of the tissues and their combinations in the various groups, and the development of tissues and organs is traced by actual inspection from the lower to the higher groups. In this division of the work, special attention is paid to the technique of microscopic research. The principal methods of killing, hardening, imbedding, and cutting vegetable tissues are taken up in detail. Application of these methods is made by each student in the series of microscopic slides prepared by him during the first half-year. Towards the close of this division of the work, considerable time is given to the subject of cell-multiplication and the changes which take place during the growth of parts.

In the second half-year, the work comprises an investigation of the principles which are accepted in Vegetable Physiology. The experimental study is carried on at the laboratories of the Botanic Garden. Much attention is devoted to the subject of adaptation of plants to their surroundings. The greenhouses and garden provide abundant material for these experiments and observations.

Botany 4. — Cryptogamic Botany. — Lectures and laboratory work. Asst. Professor Thaxter.

This course, which is only open to students who have taken Botany 1 and 2, is designed as a sequel to Botany 2. Two or three lectures are given a week in addition to which a minimum of six hours a week of laboratory work is required. The course deals with the Thallophytes (Bacteria, Mycetozoa, Fungi, and Algae) and with the higher cryptogams (Hepatics,

Mosses, Ferns, and Fern Allies) in alternate years and may be taken twice successively. The subject for 1900–01 will be the Thallophytes. The course is designed as a foundation for more special work in Botany 20*b*, as well as to afford to students intending to study medicine or to teach general cryptogamic botany in high schools or colleges an opportunity for acquiring a knowledge of the lower plants sufficient for their purposes.

BOTANY 5. — The Principles of Botanical Classification, Ecology, and Plant Distribution. Professor GOODALE.

Omitted in 1900–01.

This course, open to those who have taken Courses 1, 2, and 3, or their equivalents, has been established with special reference to those who desire to give attention to certain aspects of Systematic Botany. The work consists of practice in botanical description and delineation, and in the study of affinities, distribution and uses. The Botanic Garden is freely drawn upon for material, and this material, when necessary, is supplemented by the collections of dried plants in the Botanical Museum. There is in the laboratory a small Herbarium for comparisons.

The economic part of the course considers the more important useful plants and their products.

The lectures deal with the history of Botanical Classification.

Attention is paid in this course to approved methods of collecting and preserving botanical specimens.

BOTANY 20*a*. — Structure and Development of Phanerogams. — Experimental Vegetable Physiology. — Economic and Medical Botany. Dr. TRUE.

Only those who have taken Botanical Courses 1, 2, 3, 4, and 5, or their equivalents, are permitted to enter on this course. With the advice of the instructor, students select some special topic in one of the branches of botanical research above specified, and carry on their work independently, reporting their results from time to time. The collections at the Gray Herbarium are open to properly qualified students who confer with the Curator.

BOTANY 20*b*. — Structure and Development of Cryptogams. Asst. Professor THAXTER.

This course is intended for the preparation for and prosecution of original research on the subject. The work requires considerable time, and is adapted to students who have reached a stage of their studies where

they can with profit attempt special work, having in view the preparation of an original paper on some subject. The course is further open to properly qualified persons who desire to acquire a special and more or less systematic knowledge of any of the groups of cryptogams.

HORTICULTURE.*

HORTICULTURE 1*a*. — Lectures, Reading, Laboratory, Greenhouse and Field Work. Given at the Bussey Institution. Mr. WATSON.

Preparation of soils for horticultural purposes; management of plants, including methods of propagation from seeds, cuttings, and grafts; planting and pruning; methods of obtaining new varieties of plants; arrangement and care of gardens, nurseries, orchards, and the construction of hot-beds, pits, and green-houses. A large amount of time will be devoted to actual work with plants in the green-house and field operations.

HORTICULTURE 1*b*. — Lectures, Reading, Laboratory, Greenhouse, and Field Work. Given at the Bussey Institution. Mr. MORSE.

Organic enemies of plants. Diseases due to smuts, rusts, blights, and mildews. Bacterial and constitutional diseases. Structure and habits of insects and methods of combating those kinds which are injurious. Beneficial insects. Influence of insects in pollination. Materials and implements used in spraying to destroy fungi, and repel the attacks of insects. Injuries caused by nematodes, earthworms, birds, mice, and other animals. The lectures are supplemented by laboratory work, which consists of practice in diagnosing diseases and identifying insects in order that the student may become familiar with many of the common enemies of plants.

HORTICULTURE 2. — Study of Plants in relation to Planting Design. — Lectures, Reading, Greenhouse and Field Work. Given at the Bussey Institution. Mr. WATSON.

This course is intended to familiarize the student with the various plants which are available for landscape planting. Field-work for the identification of species at all seasons, for the study of mass, texture, and color of foliage form the basis of the course. Study of the hardiness of plants, and methods of propagation will be included. While the Arnold Arboretum will be depended upon as a field for most of the out-door

* Given at the Bussey Institution.

work, excursions will be made to other collections as well as to nurseries and parks. In order to ensure that familiarity with plants which is essential to the courses in fourth-year landscape and planting design, this course will be supplemented by summer work with living plants during July and September, six days a week, meeting the instructor for conference and examination once a week.

Horticulture 3. — Planting Design. — Lectures, Field-Work, Drawing. Given at the Bussey Institution. Messrs. Olmsted and Watson.

While the previous planting course deals primarily with the characteristics of plants as individuals, this course deals with them as elements for the formation of plantations in relation to landscape and architectural forms. The course will be closely associated with the courses in landscape design at Cambridge, and many drawing-board problems will be referred to the field for supplementary study. Field study of plants will be continued throughout the course, including exercises in practical sylviculture. Excursions will be made to reservations, parks, civic buildings and private estates as well as to districts possessing natural characteristics of interest in this connection.

ZOÖLOGY.

Zoölogy 1. — Zoölogy. — Lectures and laboratory exercises. Asst. Professor G. H. Parker, Mr. Breed, and other assistants.

This course is designed to acquaint students with the general principles of Zoölogy, and is required as preparation for all other courses in Zoölogy. It includes a brief historical consideration of the science and its subdivisions, and a discussion of the characteristics of animals as represented by their structure and activities. The chief groups of the animal kingdom are outlined and a number of their common representatives described. The distribution of animals in time and space is considered. The study of the structure and functions of cells, tissues, and organs is taken up, as well as the consideration of the forms of animals. The principles governing animal development are dealt with. The relations of animals to their environment and the various theories offered to explain how the modification of animals has been effected are considered.

For collateral reading students are expected to procure Thomson ('99), R. Hertwig ('96), or Parker and Haswell (1900). For more extended reading in connection with parts of the course the following books will be found of service: on systematic zoölogy, Leunis ('83–86); on distributional zoölogy, Beddard ('95), Wallace ('76); on morphology, Parker

and Haswell ('97), Lang ('88–94), Wilson (1900), Korschelt und Heider ('90–93); on physiology, Verworn ('95), Huxley (1900); on oecology, Semper ('81); on theories of evolution, Darwin ('80), Osborn ('94).

The laboratory exercises, which do not require dissection by the student, consist of a study of material to illustrate the topics treated of in the lectures. These exercises are supplemented by visits to the exhibition rooms of the museum and, weather permitting, by field excursions.

Zoölogy 2. — Morphology of Animals. — Lectures and laboratory work. Dr. W. E. Castle, Mr. Crawley, and a second assistant.

This course may be taken separately from Botany 2 only with the consent of the instructor. It is open to those only who have taken Zoölogy 1 or its equivalent. Its aim is to afford in connection with Botany 2 the necessary elementary training for those who desire to pursue subsequently the study of some branch of Biology. Students intending to elect this course are strongly advised to take Botany 2 in the same year. Since Zoölogy 2 is required as a preparation for several other electives, it should be taken early in the college course; if possible, not later than the second year. It may be taken, under some conditions, even in the same year with Zoölogy 1.

The lectures in this course are given on Mondays, Fridays, and occasionally on Wednesdays. They deal with the morphology and biology of the more important groups of animals, and follow immediately the dissection or microscopical examination of a selected representative of each of the groups.

Laboratory hours may be arranged by consultation with the instructor, but must be on the days named.

The best books for reading in connection with the course are Parker and Haswell ('97) or (1900), and Lang ('88–94). The following works of reference will also be found of value: Delage et Hérouard ('96—) for the classification, anatomy, morphology, and special physiology of invertebrates; Korschelt und Heider ('90–93) for the development of invertebrates; Gaupp ('96—) for the anatomy of the frog; and Leunis ('83–86) for the classification of vertebrates and invertebrates.

Zoölogy 3. — Comparative Anatomy of Vertebrates. — Lectures, laboratory work and reports. Dr. Rand and Mr. Ordway.

Course 3 is open to those only who have taken Courses 1 and 2.

This course is intended for those who are particularly interested in Zoölogy, and also for those who wish to lay a broad foundation for their subsequent study of human anatomy as medical students.

Lectures are given on Tuesdays and Thursdays. On Saturdays a demonstration or other informal exercise may be held, at the option of the instructor. In the lectures special attention is given to evidences of progressive modifications in the structure of the organs as exhibited in passing from lower to higher vertebrates.

The laboratory work requires at least six hours a week, and must be done on the days named.

The following text-books are recommended: Wiedersheim ('98); Gegenbaur ('98); Parker and Haswell ('97), vol. 2; O. Hertwig ('96); and Wiedersheim ('93).

Zoölogy 4. — Microscopical Anatomy. — Lectures and laboratory work. Professor Mark and Dr. Rand.

Course 4 is preparatory to Courses 5 and 20*a*. It is open to those only who have taken Course 2, and may be taken advantageously either *after* or with Course 3. It is intended for those who wish to prepare themselves to carry on independent investigations. It presupposes an elementary knowledge of animal morphology, and some familiarity with the use of the microscope. As the number of students who can be accommodated is small, preference will be given to those preparing to take Course 5 or 20*a*.

In this course instruction is given in methods of investigation, the animal studied being some invertebrate. There will be two, or, at the option of the instructor, three lectures a week. The laboratory work should be arranged for the morning hours of Mondays, Wednesdays, and Fridays.

Students are advised to buy Lee and Mayer ('98) or Lee ('96), and Gage ('96). The following will also be found useful: Behrens, Kossel und Schiefferdecker ('89), Carpenter ('91), and Apáthy ('96—).

Zoölogy 5. — Embryology of Vertebrates. — Lectures and laboratory work. Professor Mark and Dr. Rand.

Course 5 is open to those only who have taken Course 4.

The lectures in this course deal in a comparative way with the development of Vertebrates. The laboratory work consists in the preparation and study of the chick and other vertebrates at successive stages of development.

Students should procure Foster and Balfour ('83) and O. Hertwig ('96). In addition are recommended Marshall ('93), Minot ('93), Schultze ('97), and Kollmann ('98).

Zoölogy 9. — Fossil Invertebrates. — Lectures and laboratory work. Asst. Professor R. T. Jackson.

Course 9 requires Course 1 and Geology 4, or their equivalents, as preparation, and Course 2 and Geology 5 are strongly recommended.

This course is intended to give in zoölogical sequence an acquaintance with the geological history of Invertebrates. It considers the structure and development of representative fossil types and their systematic relations to one another and to recent allies. Attention is given to phylogenetic relations as expressed in the development of the individual and in systematic series. The geological occurrence of each group of animals and their relative importance as rock builders are considered.

Students will find Littel (1900) a valuable aid in this course.

Zoölogy 9*a*. — Fossil Invertebrates. — Advanced studies of special groups. — Lectures and laboratory work. Asst. Professor Jackson.

Course 9*a* is open to those only who have taken Course 9, or Geology 14.

This course consists of laboratory work with accompanying lectures. It takes up limited groups. such as Actinozoa, Mollusca, Trilobita, etc., and treats of them critically and more in detail than is possible in a general survey of the subject, such as is aimed at in the introductory course, 9. The groups selected will vary according to the needs of students or the pleasure of the instructor.

Zoölogy 10. — Experimental Morphology. — Ontogenesis. — Lectures, laboratory work, and a thesis. Dr. Castle.

Courses 10 and 11 are open to those only who have taken Course 2, and may be taken advantageously either *after* or with Course 3. These courses are regularly given in alternate years and are not dependent upon each other; and accordingly may be taken in either sequence.

Course 10 is designed for those who are interested in experimental work. The lectures treat of the normal activities and structure of protoplasm and the modifications which they undergo through the action of different chemical and physical agents. Among other topics, are discussed response to stimuli, and the influence on the individual of changes in environment brought to bear either on the adult or the embryo.

These courses require at least such a knowledge of the structure of animals and plants as is gained in Course 2 and Botany 2, and a knowledge of microscopic technique will be found of advantage, although not necessary.

Students will find useful Verworn ('95), Morgan ('97), and Davenport ('97–99).

ZOÖLOGY 11. — Experimental Morphology. — Phylogenesis. — Lectures, laboratory work, and a thesis. Dr. CASTLE.

Omitted in 1900–01.

This course is intended for those who desire to pay attention to the process involved in the development of the race. The lectures deal with variation and heredity from a statistical and experimental study of variation. In succession are studied: Individual variation, sports, and correlated variation; normal heredity and results of crossing; and selection. In conclusion a critical examination of the different theories of phylogenesis is made.

For a statement concerning laboratory work and preparation required for the course, see under Course 10.

Students will find the following books useful: Darwin ('76), Galton ('89), Delage ('95).

ZOÖLOGY 13. — Introduction to the Study of the Nervous System. — Lectures and laboratory work. Asst. Professor G. H. PARKER.

This course is intended for those who wish to become acquainted with the structure and genesis of the chief animal tissues, and especially with the structure and functions of the nervous elements in their relations to other tissue elements.

Course 13 is open to those only who have taken Course 2 or its equivalent and who have taken or are taking Course 3.

The laboratory work requires at least six hours a week and must be done on the days named.

For use in connection with the laboratory work students should procure Stöhr ('98). For collateral reading in connection with the lectures the following books will be found of service: Barker ('99), v. Lenhossék ('95), and van Gehuchten (1900).

ZOÖLOGY 15. — The Nervous System and its Terminal Organs. — Sense Organs. — Lectures and reports. Asst. Professor G. H. PARKER.

Omitted in 1900–01.

ZOÖLOGY 16. — The Nervous System and its Terminal Organs. — Central Nervous Organs and Terminal Organs of Efferent Nerves. — Lectures, laboratory work, and reports. Asst. Professor G. H. PARKER.

Courses 15 and 16 are designed primarily for those who intend to make a special study of the nervous system and its terminal organs.

These courses are regularly given in alternate years. They should ordinarily be preceded by Course 3, and after 1900–01 will be open to those only who have taken Course 13. They are independent of each other and may be taken in either sequence. In each course the student will be given a special topic for laboratory work, the results of which are to be presented at the end of the course in the form of a written report.

In Course 15 either Jourdan ('89) or Lubbock ('88) will be found serviceable.

In Course 16 either Edinger (1900) or Loeb ('99) are required, and Ramon y Cajal ('94), Barker ('99), Van Gehuchten (1900), Donaldson ('95) and Romanes ('93) will be found serviceable.

Zoölogy 20*a*. — Anatomy and Development of Vertebrates and Invertebrates. Professor Mark.

This course is designed for those only who are competent, with the aid of the instructor, to carry on some original investigation. Each student selects, with the advice of the instructor, the subject of his research, and the results are embodied in a thesis. The investigations of advanced students, when considered worthy of publication, usually appear in the Bulletin of the Museum.

Persons contemplating this work will find it to their advantage to consult the instructor at an early date, — if possible, as early as the first of April of the academic year preceding that in which the work is to be done.

The Zoölogical Club.

The instructors and advanced students in Zoölogy hold weekly meetings for the presentation and discussion of original work and the review of current zoölogical literature.

GEOLOGY.

Geology *A*. — Physiography of the Lands (elementary course). — Lectures, written exercises, laboratory and field work. Dr. Daly and Mr. Boutwell.

Course *A* is required for students who intend to take Courses 6, 7, and 20; it is recommended to students expecting to take Course 8, in preparation for the more advanced courses in Geology.

The lectures consider the following subjects: The form and size of the earth. — Terrestrial magnetism. — The land: continental forms, plains, plateaus, rivers, lakes, mountains, volanic forms, coasts, islands, considered in relation to geographical classification and evolution and to their effect on human development. Lantern illustrations will be frequently

used. The laboratory work is directed to the study of models, diagrams, maps and views of various topographic types in different parts of the world.

GEOLOGY *B*. — Elementary Meteorology. — Lectures, written exercises, observations, and laboratory work. Asst. Professor WARD and Mr. ——.

Course *B* is required for admission to Courses 1, 19, and 25.

The lectures present the subject under the following headings: the earth's atmosphere: its composition, temperature, pressure and general circulation. — The moisture of the atmosphere: dew, frost, clouds, rain-fall. — Storms: cyclones, thunderstorms, tornadoes. — Weather. — Climate.

The laboratory work consists chiefly in the construction and study of weather maps and meteorological diagrams and photographs; practice in the use of ordinary meteorological instruments; individual record of observations; weather forecasting, etc.

GEOLOGY 4. — Elementary Geology. — Lectures, with collateral reading. Professor SHALER, assisted by Mr. WOODMAN.

This course gives a general knowledge of Geology which may serve either as an outline of this branch of Natural History for those whose main line of study is in other directions, or as a basis for further geological work for those who intend to devote themselves to Geology. (See Geology 5, below.)

GEOLOGY 5. — Elementary Field and Laboratory Geology. Mr. J. B. WOODWORTH, assisted by Messrs. WOODMAN and ——.

Course 5 may be taken only with or after Course 4, though in the same examination group. It may be taken with Course 4.

Courses 4 and 5, or their equivalents, are required for admission to the higher courses in Geology (8, 9, 10, 11, 14, 14*a*, 16, 17, 18). They are recommended to students intending to take the course in Physical Geography.

The laboratory exercises in this course are designed to illustrate by means of specimens, models, photographs, maps, and sections, the principal original and secondary structures of rocks; the origin and mode of occurrence of rocks in the earth's crust, their cycles of alteration and change; their interpretation and representation in geological surveys.

The field excursions comprise a series of observations upon the weathering of rocks; sea-shore phenomena, including beaches, cliffs, marine

marshes; glacial phenomena, including glacial erosion, moraines, drumlins, glacial sand-plains, eskers, kames; igneous rocks, including dikes, sills, ancient lava-flows, local or contact metamorphism and the genesis of new minerals; stratified rocks, including conglomerates, sandstones, slates; faulted igneous and sedimentary rocks; folds; joints, cleavage, schistosity, etc. Opportunity will be given for practice in constructing maps and sections, measuring the thickness of strata, and determining the relative ages of geological structures.

GEOLOGY 1. — Meteorology (second course). — Lectures, written exercises, and laboratory work. Asst. Professor WARD.

Course 1 is open to those only who have taken Course *B*.

This course is intended to enable students to make a more thorough study of various important atmospheric phenomena than is possible in the elementary course in Meteorology (Geology *B*). The subjects discussed are as follows: dew, frost and clouds, tropical and extra-tropical cyclones, cyclonic winds, thunderstorms, tornadoes and waterspouts.

The laboratory work consists in the examination of charts, photographs, diagrams, etc., and in the study of text-books, reports and articles bearing upon these illustrations.

GEOLOGY 6. — Physiography of the United States. — Lectures, library work, and reports. Professor DAVIS.

GEOLOGY 7. — Physiography of Europe. — Lectures, library work, and reports. Professor DAVIS.

Omitted in 1900–01.

Courses 6 and 7 are given in alternate years. Course *A* is required, and Course 4 is recommended, in preparation for either; and in Course 7 some use of French and German books will be required.

In these courses, the subject will be treated on the plan developed in the elementary course (Geology *A*); the countries considered being divided first according to their geological structure, second according to their geographical development. The physical features of each area will be illustrated chiefly by maps of large scale, partly by photographs. Attention will be given to the relation of structure and form to conditions of human life, occupations, products, etc., in order that the course shall have value to the student of History and Economics, as well as to the student of Geography.

It is probable that courses on the Physiography of South America and of Asia, will be offered one or two years hence, as "half-courses," given in alternate years.

GEOLOGY 8. — General Critical Geology. — Lectures, field work, reports, and reading. Mr. J. B. WOODWORTH, assisted by Mr. WOODMAN.

Course 8 is open to those students only who have attained satisfactory grades in Courses 4 and 5, or their equivalents (see Course S 1, p. 205). Students taking this course must keep Thursday or Friday afternoon free for field work and conference.

The lectures treat of the principles of classification of geological phenomena, the geological processes, their products and criteria; the nature of the forces involved therein; volcanic phenomena; movements of solid masses; the action of water, ice, wind, and life; geological history, including the physical changes, rocks, life, and climate of the principal periods, with reference to evolution, time ratios, continuity of geological processes, etc. Lantern slides are frequently used in illustrating the lectures.

The field work consists of half-day excursions to localities in the neighborhood of Cambridge, illustrating problems in the structure and geological history of the Boston, Norfolk, and Narragansett areas.

The class is divided into sections for library work and consultation. The following works will be useful for reference in 1900–01: Sir A. Geikie, *Text-book of Geology*, 3d ed., 1893. J. D. Dana, *Manual of Geology*, 4th ed., 1895. De Lapparent, *Traité de Géologie*, 4th ed., 1900. Ed. Suess (*Das Antlitz der Erde*), *La Face de la Terre*. The results of winter reading are to be presented in the form of reports and a bibliography of some subject germane to the course.

GEOLOGY 9. — Structural and Dynamical Geology of the United States. — Lectures, with library work and reports. Dr. JAGGAR.

Omitted in 1900–01; to be given in 1901–02.

Course 9 is open to those only who have attained satisfactory grades in Courses 4 and 5. Course *A* and 8 are also recommended.

The aim of this course is to provide opportunity for critical study of the geological structure of the United States in the light of the most recent surveys, with special reference to continental and coastal oscillations, stratigraphy of the larger formations, structure and origin of the mountain ranges, and distribution of eruptive rocks and epochs of volcanic eruption.

In the lectures, the complex structure of the earlier formations is demonstrated as far as possible by analogy with recent phenomena, the area of the United States being used to furnish illustrations of existing processes, and of typical structures resulting from similar processes in the

past. Importance is attached to the study of the rock-making agencies of the present time. The lectures are illustrated by stereopticon views, photographs, models, and specimens.

A third hour each week is devoted to reviews, by the students, of recent publications bearing on the subjects discussed in the lectures. The following are among the principal subjects treated: Appalachian stratigraphy; greater unconformities of the Atlantic border; folds and faults of the Appalachians; ancient volcanoes of the eastern United States; Rocky mountain stratigraphy; the Coast ranges; the post-Laramie uplifts; Tertiary volcanoes of the western United States; structure of the great plains.

Geology 10. — Mining Geology. — The origin and geological relations of ore deposits. — Lectures, reading, and occasional field-work. Asst. Professor Smyth.

Courses 4 and 5 and Mineralogy 2, or their equivalents, are required in preparation for this course.

This course is designed to give a general account of the ores of the more important metals. It is divided into two parts. The first deals with ore-deposits in their general mineralogical and geological relations, including their mineralogical and structural characters, the sources from which they have been derived and the processes by which they have been formed. In the second part of the course the more important sources of the world's supply of each metal are studied in some detail. Special attention is given to the ores of iron, copper, nickel, gold, silver, lead, zinc, tin and manganese.

Geology 11. — Oceanography. — The geology and physiography of the oceans and ocean-basins. — Lectures, library work, and reports. Dr. Daly.

Course 11 is open to those only who have passed in Courses 4 and 5, or their equivalents. Courses *A*, 8, and Zoölogy 1 are also recommended.

The objective of the lectures in this course is to give a comprehensive view of what is known regarding the larger problems of the ocean. The scope of the course is indicated by the following list of topics: Deep sea exploration; morphology and origin of the ocean-basins; the doctrine of the permanence of continents; the physical and chemical properties of sea-water; waves; tides; ocean currents: their origin, distribution and effects; the physical conditions of life in the ocean; the distribution of marine organisms; sediments of the sea-floor; ancient marine sediments; palaeogeography; oceanic islands; submarine volcanic eruptions; applied oceanography: relation of the science to fisheries.

GEOLOGY 14. — General Palaeontology. — Lectures, with collateral reading, and theses. Professor SHALER and Asst. Professor JACKSON.

This course is open to those only who have taken Geology 4 and 5, or have an equivalent preparation. The ability to read scientific French and German is desirable.

This course is intended to give an acquaintance with the geological history of the various organic series, from the point of view of the student of organic life in general rather than in the way required by the practical geologist. Special attention is devoted to the theories concerning the origin and development of animals as far as these questions are brought into view in the palaeontological record. The course varies from year to year, but the the following synopsis will indicate the subjects generally treated. Conditions of organic life; heat, moisture, etc.; laws of the distribution of life on land and sea; conditions of fossilization; metamorphism and the preservation of the geological record; climatal and other evidence afforded by fossils. General history of the great divisions of the animal kingdom; the development of the motor system in animals; development of the skeletal, nervous, visual, reproductive, and other systems of the divisions; theories concerning the appearance and disappearance of animals as shown by fossils; palaeontological history of man.

GEOLOGY 14*a*. — General Palaeontology. — Conferences and laboratory work. Asst. Professor JACKSON.

Course 14*a* is open to those only who take or have taken Course 14. Although in the same examination group with Course 14, the two courses may be taken in the same year.

The laboratory exercises in this course are designed to illustrate the lecture work of Geology 14. In them representative genera of animals and plants occurring as fossils, are studied so as to give the student an acquaintance with the more important types. The lectures are explanatory of the types studied in the laboratory.

It is essential that this course or Zoölogy 9, be taken as a preparation for Course 15.

GEOLOGY 15. — Historical Geology. — Laboratory and field-work, with conferences and theses. Professor SHALER and Asst. Professor JACKSON.

This course is open to those only who have some knowledge of Geology and Palaeontology. Geology 8, S2, and either 14 with 14*a* or Zoölogy 9 afford a suitable preparation.

The course is designed particularly for those who intend making a specialty in Geology; its aim is to teach the use of fossils in identifying geological horizons, especially in the North American series of rocks. Students who take this course will be expected to spend some weeks in field work in the eastern part of the United States.

Geology 16. — Glacial Geology. — Lectures, conferences, field-work and reports. Mr. J. B. Woodworth.

Course 16 is open to those only who have taken Courses 4 and 5, or their equivalents. Courses *A*, *B*, 6, and 8 are recommended. Students taking this course must keep one half-day in each week of the autumn free for field work.

This course treats of the geological work of ice, with particular reference to the Pleistocene Period; the glacial theory; the classification, distribution, the age of glacial deposits; their relations to other terrigenous deposits, and to problems of archaeology, engineering, road-making, water-supply, mason's materials, landscape gardening, etc. The field work affords practice in the determination and mapping of glacial deposits.

Geology 17. — Experimental and Dynamical Geology. — Lectures, illustrated by experiments, with laboratory work and reports. Dr. Jaggar.

Course 17 is open to those only who have attained satisfactory grades in Courses 4 and 5. Courses *A* and Mineralogy 2 are recommended. Ability to read French or German is desirable.

In this course the dynamical and chemical problems of geology are described, and geological processes are illustrated by experiments performed in the presence of the class. Experimental Geology includes analytical observation and measurement of natural phenomena, as well as minature imitation in the laboratory. As distinct from those courses which treat of form and structure, this course deals with the *physical agents* that produce land forms and geological structures. The work of former experimenters is reviewed, and the laboratory is equipped with apparatus specially designed to reproduce processes simulating erosion, sedimentation, deformation, eruption and mineral synthesis.

The lectures present the following subjects: *Erosion:* agents of disintegration, hydrographic measurement of streams, action of springs and geysers; experimental erosion and stream development, wear of rocks, turbidity of water, glacial motion and striation. *Sedimentation:* carrying power of wind and water, stratification; experimental delta deposition, unconformity, shore currents, ripple-mark. *Deformation:* measurement

of coast oscillation, faults and earthquakes; experimental folds, faults, joints, schistosity, lithifaction. *Eruption:* measurement of active volcanoes; experimental columnar structure, growth of cones, intrusion, imitation of volcanoes, fusing point of lavas. *Crystallization:* hot-spring deposits, solidification of lavas; rock synthesis and its geological significance.

GEOLOGY 18. — Economic Geology. — Non-metalliferous products and water-supply. — Lectures, reading, and a thesis. Professor SHALER and Asst. Professor SMYTH.

Course 18 is open to those only who have taken Courses 4 and 5, or Course S1, and Mineralogy 2. Course 8 and Mineralogy 12 are also desirable as a preparation.

This course gives a general account of the occurrence and useful qualities of the principal non-metalic mineral products, special attention being given to those of the United States. The subjects treated are water supply; coal, petroleum, natural gas and other hydro-carbons; phosphates; building stones and materials; road-materials; clays; cement; salts; sulphur, etc.

GEOLOGY 19. — General Climatology. — Lectures, library work, and a thesis. Asst. Professor WARD.

Course 19 is open to those only who have obtained a satisfactory grade in Course *B*, and to students in the Graduate School having equivalent preparation. It is recommended to those who intend to study medicine.

This course is designed to give a general knowledge of Climatology in its broader aspects. The lectures present the subject according to the following heads: The astronomical relations of earth and sun, the changes of the seasons, and the climatic zones and their subdivisions. — Climatic factors. — Controls of climate. — Relations of climate and man, including the climatic control of habitability, occupation, migrations, government, etc. — Physiological effects of different climates. — Medical Climatology. — Acclimatization. — Geological, historical, and periodic changes of climate.

The library and written work involves the special investigation by each student of some subject in connection with the course, and the preparation of a thesis.

GEOLOGY 20. — Physiography (advanced course). — Conferences, reports, and theses. Professor DAVIS.

This course is open to those who have passed satisfactorily in Geology *A* and 6 or 7; ability to read German and French and a general understanding of Geology are desirable.

This course is designed to give opportunity for study supplementary to the more elementary courses in Physiography; it will consist of investigation of certain topics selected by the students with the advice of the instructor. Written reports on work accomplished are made by each student. Attendance on the Geological Conference (see p. 213) is expected of students taking this course.

GEOLOGY 21. — Mining Geology (advanced course). — Conferences, reports, and theses. Professor SMYTH.

Omitted in 1900–01.

Geology 10 and Mineralogy 12 are required in preparation for this course.

This course is offered in alternate years with Course 27.

It is designed to supplement the work of Course 10, by giving advanced students an opportunity to follow out more thoroughly special topics in connection with the geology of ore-deposits.

GEOLOGY 22. — Advanced Geological Field Work. — Areal Geology in the vicinity of Boston. — Library work, conferences, and theses. Dr. JAGGAR.

Course 22 is open to those only who have attained a satisfactory grade in Course 8 or 10, and who have studied mineralogy. Course S2, or summer work in Mining 12 and Mineralogy 12 are recommended.

This course affords systematic training in methods and practice of geological surveying in the field, and in the preparation of geological maps and reports. During the fall and spring one full day's work each week in the field is required, under the immediate supervision of the instructor. Each student is assigned a definite problem or area, and is required to present his results for discussion at the regular meetings of the course. A few introductory lectures are given, describing the region, the principal rock types, methods of note-taking, use of field instruments and specimen-collecting. During the winter the work consists of map-making, drawing, experimental or library research, or field work upon special problems. Winter lectures treat of the correlation of the region about Boston with adjacent areas in New England, the structural, lithological and palaeontological problems that are here open to investigation, and their bearing upon the field work of the course.

At the close of each field season, a carefully compiled written report, with maps, drawings, and sections, presented in a prescribed form, is accepted as the student's record. These theses are filed, with a view to eventual publication of a Geological map of the Boston area.

Students in Geology 22 are expected to attend the Geological Conferences (see p. 213) and to make occasional reports of work in progress.

GEOLOGY 23. — Geological Investigation in the Field and Laboratory, under the supervision of Professors SHALER, DAVIS, and SMYTH, Mr. J. B. WOODWORTH and Dr. JAGGAR.

This course is intended for students who have already passed in Course 22, and provides for systematic work leading to results worthy of publication.

The following special topics will, among others, be offered for study during the winter of 1900–01: —

Seashore Phenomena. Auriferous Gravels. Inundated and Arid Lands. Professor SHALER.

Glacial Sand-Plains. Professor DAVIS.

Special Problems in Economic Geology. Professor SMYTH.

The study and mapping of some area of glacial drift in New England.

A study of the rock joints in the Boston area. Mr. J. B. WOODWORTH.

Experimental Geology, for students who desire to extend the instruction of Courses 9, 22, and 17 into original investigation of structural or dynamical topics. Dr. JAGGAR.

Attendance at the Geological Conference (see p. 213) is expected of students taking this course.

GEOLOGY 24. — Advanced Palaeontology. — Laboratory work and theses. Professor SHALER and Asst. Professor JACKSON.

This course is open to those only who have studied Paleontology and Zoölogy.

Each student will devote his time to the study of the palaeontology of some group of animals or plants. He is expected to take in hand the literature of the subject, to become personally familiar with all the important living and fossil members of the group, and to present the results of his study in a thesis.

GEOLOGY 25. — Special Climatology. — Lectures, library work, and reports. Asst. Professor WARD.

Course 25 is open to those only who have obtained a satisfactory grade in Course *B*, and to students in the Graduate School having equivalent preparation. It may be taken in the same year with Geology 19, or independently of that course. It is recommended to those who intend to study medicine.

In this course are considered the climates of North America. Special attention is given to the climate of the United States.

GEOLOGY 27. — Pre-Cambrian Geology of North America: with especial reference to the stratigraphy and economics of the rocks in the original Laurentian area and the region of the Great Lakes. Professor SMYTH.

Geology 8 and Mineralogy 2 are required in preparation for Geology 27; and Mineralogy 12 is recommended.

The object of this course is to give a systematic account of the present state of knowledge of the pre-Cambrian rocks of the North American continent. The principal subjects dealt with in the lectures are the lithological character of these rocks and their stratigraphical relations, so far as these have been determined, in the various regions in which they have been described; the historical development of opinion regarding their division into groups; and the time relations of these groups in separated areas.

Especial attention is devoted to the region of the Great Lakes, where, owing to relative simplicity of structure and a generally moderate degree of metamorphism, more definite progress towards a final solution of the problems of classification has been made than in any other area. During the course, the subjects of metamorphism, the development of secondary rock structures, and the principles of correlation applicable to non-fossiliferous formations, are considered in detail.

SUMMER COURSES IN GEOLOGY AND GEOGRAPHY.

A full account of the Summer Courses is published in a special pamphlet which may be had on application to the Secretary.

The Summer Courses as given in 1900 were as follows: —

GEOLOGY S1. — Elementary course.

An elementary lecture, laboratory, and field course in Geology by Mr. J. E. WOODMAN, beginning July 5th and lasting six weeks. Professor SHALER gave ten in this course of lectures on general Physical Geology.

This course will be in a general way parallel to the courses in Elementary Geology (Geology 4 and 5) given during the academic year, but will contain a larger share of field work, It is intended particularly for teachers and others who wish to acquire an elementary knowledge of geological processes and forms, and to learn methods of field work. It is especially recommended for those who intend to study or to teach Physiography. Undergraduate members of the class who desire to count it as a half-course towards the degrees of A.B. or S.B. will be required to

take a field and laboratory examination. For a detailed statement, see Summer School pamphlet.

The fee for this course is $20.

GEOLOGY S2 .— Geological field-work.

An advanced course in Geological Field Work: conducted in New York and Connecticut from July 5 to August 15. Professor A. P. BRIGHAM (of Colgate University) and Mr. J. B. WOODWORTH.

This course is open to men who have a general knowledge of Geology, or to students who have taken Courses 4 and 5, Course S1, or an equivalent of these courses.

The fee for the course is $20. See special pamphlet descriptive of summer courses.

GEOLOGY S3. — Advanced field-work.

Training in Field Research, and in the methods of professional Geological Field-work. Professor SHALER.

Students of maturity and training may be furnished opportunity for advanced individual study in connection with the professional work of the instructor. For the present season this lies in New England and elsewhere. The results of the work must be presented in the form of a thesis.

The fee for the couse is $20.

GEOLOGY S4. — Geography.

A course in Geography by Professor DAVIS and Mr. BURR in the geographical lecture-room and laboratories, Harvard University Museum, Cambridge, beginning Wednesday, July 5, and lasting six weeks.

The fee for this course is $20.

The course is designed primarily to meet the needs of teachers of Geography in secondary schools. It will also aid teachers in Normal Schools and superintendents, who wish to inform themselves on the methods and results of modern geographical study.

In the course, the attendance and work of every student is entirely voluntary. No examinations are held. The morning is given to lectures and conferences. Afternoons may be given to individual work on maps and models in the laboratory or on reference books in the library, or to excursions in the field. Saturday will be a free day, except when given to the longer excursions.

Fuller information concerning the course may be obtained from the special pamphlet on the Summer School, or by addressing Professor W. M. DAVIS, Cambridge, Mass.

MINERALOGY AND PETROGRAPHY.

MINERALOGY 2. — Mineralogy (including Crystallography, Physical and Chemical Mineralogy, and Descriptive Mineralogy). Professor WOLFF, Dr. PALACHE, and an assistant.

Open to those only who take or have taken Chemistry 1. Students proposing to study Petrography are advised to take Course 8 with Course 2.

Text-book: Dana's *Text-book of Mineralogy.*

The lectures are given at the hours mentioned in the programme. The amount of laboratory work necesssary for the average student will be about five hours a week. The lectures first take up Crystallography, while the laboratory work is upon the collection of crystal models and natural crystals. An outline of Physical and especially of Optical Mineralogy is then given and illustrated in the lectures by experiments and demonstrations with the polariscope, which students can afterwards repeat in the laboratory. The larger part of the lectures and laboratory work is, however, devoted to systematic Descriptive and Determinative Mineralogy, which includes the chemical relations of the various species. The lectures are illustrated by specimens from the several collections, while in the laboratory students are taught the various blow-pipe and other chemical tests, which they apply themselves on known and undetermined material. They follow the lectures with the minerals in the collection, and are then given drawers of unknown minerals to determine.

A student who has passed this course should have a knowledge of Mineralogy sufficient for all general purposes; he should be able to identify all but the rarer mineral species. If he wishes to pursue the subject further, he should take up special lines of study. The course is essential for all who wish to go on in Mineralogy or Geology, and is recommended to all those who intend to be chemists. It affords training in observation and inductive reasoning for all engaged in the natural sciences. On this account it is also fitted to form part of a general education.

MINERALOGY 3. — Building Stones. Professor WOLFF.

A course of lectures, intended for architects and for those who specialize in Economic Geology. It cannot be counted towards the degree of A.B.

The lectures will describe in an elementary way the mineral constituents and geological occurrence of the principal building stones. The description and classification of the building stones of the United States, quarry regions and methods of quarrying, use in cities, defects and action of the weather, methods of examination and testing are then treated.

MINERALOGY 7. — Crystallography. — Practical exercises in the measurement, discussion, and drawing of crystals, with occasional lectures. Dr. PALACHE.

This course is open to those only who take or have taken Course 2.

The work will consist in the measurement of crystals of the various systems on the reflecting goniometer, discussion of the results, and calculation and drawing of the forms, with occasional lectures on the use of the instruments and on methods of calculation and projection.

MINERALOGY 8. — Physical Crystallography, mainly Optical Mineralogy and its applications. — Lectures and laboratory work. Professor WOLFF and Dr. PALACHE.

This course is open to those only who take or have taken Mineralogy 2. Course 7 is especially useful to chemists, and Course 8 to petrographers; while both courses are essential to those who wish to go further in Mineralogy.

The lectures will deal mainly with crystal optics, with some attention to other topics in Physical Crystallography. The later lectures will be devoted to the applications of Optical Mineralogy in the study of minerals in Mineralogy and Petrography. The lectures will be illustrated by the polariscope and other demonstrations. The laboratory work will consist in the determination of the indices of refraction and other optical constants of minerals of the several systems, partly by means of preparations which the students will make themselves, and in a certain amount of practical study of the other subjects in Physical Crystallography which are covered by the lectures. The laboratory work of Courses 7 and 8 is carried on in the advanced mineralogical laboratory.

MINERALOGY 12. — Petrography. — Lectures, laboratory work, and theses. Professor WOLFF and an assistant.

Course 12 is open to those only who have taken Geology 4 and 5, or Geology S 1, and Mineralogy 2. Course 8 is also recommended.

The lectures treat of the structure, composition, classification, origin, geographical distribution, and geological occurrence of the various families of rocks and of the problems of Lithological Geology. The microscopical characters of the rock-forming minerals and the various methods of petrographical investigation in the field and laboratory are included in the course. The work in the petrographical laboratory supplements the lectures and enables students to become familiar with rocks and with practical methods of investigation, and their application to Geology.

Mineralogy 20. — Mineralogical and Petrographical Research. Professor Wolff and Dr. Palache.

Every facility will be given to students fitted for research in Mineralogy who wish to pursue the subject. A collection of minerals for scientific use is now in process of formation and will be extended in special lines as the need arises. Students taking mineralogical research should have passed in Mineralogy 2, 7, 8, and 12, Chemistry 1, 3, 4, 9, and Geology 4 and 5. This course should be taken only if the student is able to devote at least half of his time to it; to get the full advantage of it he should devote all his time to it. The work will consist in establishing new mineral species or the revision of old ones; in the study of the relation of the physical properties to chemical composition, or in the critical examination of some of the fuller suites of species contained in the collections.

Corresponding facilities for petrographical research are offered to students with a knowledge of general petrography such as is obtained from Course 12, in connection with the extensive laboratory and library resources of the Department and the varied field-problems of the region. The work is preferably based on material which the student has collected in the field in connection with the determination of field relations, utilizing the winter months for lithological study.

MINING AND METALLURGY.

Mining 1. — Mining. — Prospecting and Exploring; Sampling and the principles of Exploitation. — Lectures, reading, and excursions. Professor Smyth.

Geology 4 and 5 and Mineralogy 2 are required in preparation for this course.

This course deals mainly with the practical methods of geology, which have for their object the discovery of mineral deposits, and the approximate determination of their extent and value. Especial attention is devoted to magnetic surveys with the dial-compass, dip-needle, and magnetometer, and their application to certain fields in the Eastern States and the Lake Superior region. Other subjects treated are diamond- and churn-drilling and test-pitting; the principles and methods of sampling; faulting in mineral deposits; and, in outline, the principal methods of opening up and working bodies of ore.

The instruction is given by lectures, illustrated with maps, photographs, and specimens. During the term, an excursion will be made to localities in New England and New York, chiefly for the purpose of practice in the use of the magnetic instruments.

METALLURGY 2. — Metallurgy. — Metallurgy of iron and steel. — Lectures, laboratory work, reading, and excursions. Mr. SAUVEUR.

Chemistry 1 is required in preparation for this course.

This course will include a description of the methods used for the production of cast iron, wrought iron and steel. The mechanical appliances will be described briefly and properly illustrated, while special effort will be made to convey a clear understanding of the chemical and physical phenomena upon which the art of the production of iron and steel is based.

The further treatment to which the metals are subjected in the production of the most important finished articles will be considered.

The properties of cast iron, wrought iron, and steel which have an industrial interest will be carefully studied, as well as the influence upon these properties of the composition and the treatment.

The complex question of the rational treatment of steel in the manufacture of finished products will receive special attention.

The constitution of iron and steel as revealed by the microscope will be studied.

The laboratory work will consist in the production of crucible steel and of some special steels, and in the testing of their properties; in the investigation of the properties of certain elements upon the soundness of castings; in case hardening; in work illustrating the effect of heat treatment upon the properties of steel (annealing, hardening, tempering, etc.); and in experimental illustration of the importance of the point of recalescence upon the properties of steel.

METALLURGY 3. — Metallurgy. — The metallurgy of copper, nickel, lead, zinc, and the minor metals. — Lectures, laboratory work, reading, and excursions. Mr. RAYMER.

Chemistry 1 is required in preparation for this course.

Under lead will be included a discussion of the choice and preparation of materials, smelting by various methods, and the desilverization and refining of products. Under copper will be included a description of plants, and a discussion of the mechanical and chemical problems involved in the treatment of ores, and in the smelting and refining of products. The discussion of nickel will follow similar lines.

The metallurgy of zinc will include a description of the methods of producing spelter and zinc-white, and a discussion of the phenomena accompanying the processes.

As much time as can be spared from the more important metals, will be devoted to the metallurgy of the minor metals.

METALLURGY 4. — Ore Dressing, Concentration, and Milling. — Wet methods of ore-treatment. — Lectures and laboratory work. Mr. RAYMER.

Engineering 1*c* and Mineralogy 2, or their equivalents, are required in preparation for this course.

The lectures will describe the principles of the dressing and concentration of lead, zinc, and iron ores; of the stamp milling, amalgamation and leaching of gold and silver ores, and the designing and erection of plants for such work.

The laboratory work will enable the student to become familiar with the use of the modern machines for ore dressing, concentration and amalgamation, including crushers, rolls, stamps, screens, jigs, vanners, slime tables, and bundles; and with their adaptability to given ores.

MINING 5. — Mining. — Metal and Coal Mining. — Exploitation. — Lectures, reading, and reports. Professor SMYTH.

Engineering 5*a* and Mining 1 are required in preparation for this course.

This course is designed to give a systematic account of the operations incident to the development and working of coal-seams, and ore-bodies of various forms, sizes, attitudes and physical characters, under different conditions. The subjects treated are surface-excavation, hydraulic and open-pit mining, tunnelling, shaft-sinking, hand- and power-drilling, explosives, systems of mining, tramming and underground-haulage, hoisting, surface-handling, drainage, and ventilation.

The instruction is given by lectures supplemented by required reading in various text-books and in professional literature. The lectures are illustrated with maps and photographs. During the term short excursions will be made to mines in New England and the neighboring States.

METALLURGY 6. — Metallurgical Chemistry. — The analysis of ores and metals (chiefly laboratory work). Mr. WHITE.

Chemistry 3 is required in preparation for this course.

The object of this course is to convey such a knowledge of analytical chemistry as should be possessed by Assayers and Mining Engineers in general.

It will consist in the quantitative determination of the common elements found in ores (Si, Fe, Zn, etc.), and in the electrolytic determination of copper.

METALLURGY 7. — Metallurgical Chemistry (advanced course). — The analysis of metals, fuels, slags, and refractory materials (chiefly laboratory work). Mr. WHITE.

Course 6 is required in preparation for this course.

The aim of this course is to impart a knowledge of analytical chemistry such as is required of the chemist connected with a metallurgical establishment.

It will consist in the complete quantitative analysis of the most important ores (of iron, copper, lead, etc.) and of metallurgical products (iron, steel, alloys, copper, matte, speiss, etc.); the analysis of fuels, fluxes, refractory materials, etc.

Special attention will be given to quick methods such as are in use in practice.

MINING 10. — Fire-Assaying (chiefly laboratory work). Mr. RAYMER.

Chemistry 1 is required as a preparation for this course.

The work of this course is mainly in the laboratory, and requires of the student eight to ten hours a week.

The following subjects are treated: The scorification assay of gold and silver ores, including cupelling, inquarting, parting and weighing; the crucible assay of gold and silver ores, including the determination of fluxes; the corrected assay of rich ores and precipitated sulphides; the amalgamation assay of free-milling ores; the combination assay of mattes, speisses, etc.; the assay of lead-ores and lead bullion; the assay of gold bullion.

MINING 11. — Mining Plant. — Hoists, pumps, drills, compressors, and haulage-equipment. — Lectures, reading, and reports. Mr. RAYMER.

Course 5 is required in preparation for this course.

The lectures will describe the designing and erection of power plants for mines; methods of transportation underground and on the surface; ventilation, natural and forced; hoisting and pumping; the generation of steam and its use in mining; the compression of air and its use in mining; the use of electricity in mining.

MINING 12. — Mining. — The Study of Mining Operations. — Field work and a report. Mr. RAYMER.

Course 1 is required as a preparation for this course.

This course begins in the Lake Superior, or some other mining region, shortly after the end of the final examination period. The student under the guidance of the instructor spends eight to ten hours a day in the study of the actual working of mines, on the surface and underground. Attention is specially directed to the plant and its arrangement, and to the various departments of underground work. After the detailed study of one or more mines has been completed, other mines and districts are visited and variations in practice compared. The student is required to take full notes each day, and to hand in a written report, with his notebook, at the end of the summer vacation.

METALLURGY 20. — Metallography and the physics of Metals. Mr. SAUVEUR.

A few lines of investigation (that may be followed by properly qualified students) are suggested below:

I. Relations between the structure of a certain metal or alloy and its physical properties.

II. Influence of the treatment (thermal and mechanical) upon the structure and properties of a certain metal or alloy.

III. Influence of impurities upon the structure and properties of a certain metal or alloy.

IV. Influence of varying proportions of the constituents of a metallic alloy upon its structure and properties.

V. Influence of the composition and treatment upon the position of the critical points of steel.

VI. Determination of the critical points of special steels which have not so far been determined.

VII. Preparation of a new special steel and investigation of its properties.

VIII. Preparation of a new metallic alloy and investigation of its properties.

IX. Investigation concerning the effect of composition and treatment upon the magnetic properties of steel.

X. Determination of the curve of fusibility of alloys of unknown constitution.

GEOLOGICAL CONFERENCE.

The instructors of the above-described courses meet their more advanced students in the Geological Laboratory at 8 on Tuesday evenings, for the presentation of reports on investigations, and for informal comment and discussion. At each meeting there will be one or more leading papers on subjects announced in the weekly Calender, and discussion will be

directed chiefly to the subjects thus presented. There will be also brief statements of work in progress by instructors and students, and comments on new publications and other matters of interest.

HYGIENE.

HYGIENE 1. — Elementary Anatomy and Physiology. — Personal Hygiene. — Emergencies. Dr. E. A. DARLING and Dr. P. H. PROVANDIE.

This is an introductory course intended to give the general knowledge of Human Anatomy, Physiology and Hygiene, which should be possessed by every student; it is adapted not only for those who intend to study Medicine or Physical Training, but also for those who wish to obtain general information on the subject.

HYGIENE 4. — Anthropomentry. — Measurements and Tests of the Body. — Effects of Age, Nurture, and Physical Training. — Lectures and Practical Exercises. Dr. D. A. SARGENT.

Systematic training is given in making measurements and tests of individuals for the purpose of determining their strength and deficiencies. Practice is also given in classifying measurements, forming typical groups and determining the relations of the individual to the group type. This course must be preceded by the course in Hygiene 1, or its equivalent.

HYGIENE 5. — Applied Anatomy and Animal Mechanics. — Action of the Muscles in different Exercises. — Demonstrations, Recitations, and Practical Exercises. Dr. D. A. SARGENT.

A study is made of the effects of various exercises upon the human organism, the physical characteristics of distinguished athletes, and the mechanical principles underlying the ability to perform great feats of strength, skill, endurance, etc.

This course must be preceded by the course in Hygiene 1, or its equivalent.

SUMMER COURSES OF INSTRUCTION.

Among the courses of instruction to be offered by Harvard University in the summer of 1901, there will be several that can be counted, under the regulations of the Faculty of Arts and Sciences, towards the degree of S.B.

For the pamphlet describing the Summer School Courses apply to J. L. LOVE, 16 University Hall, Cambridge, Mass.

PUBLICATIONS.

Some Departments of study issue periodicals or yearly volumes, embodying the work of instructors and students at the University. Other Departments make regular contributions, under an official heading, to the proceedings of certain learned societies or to journals of literature and science, existing outside of the University. The publications of the first class and those of the second which are also issued directly by the Departments are the following; including a few which, although connected with studies cultivated by the Faculty of Arts and Sciences, are independent of that Faculty: —

Harvard Oriental Series (Indo-Iranian Department): Vols. I–III issued. Vols. IV and V in press.

Harvard Studies in Classical Philology (yearly): Vols. I–X issued. Vol. XI in preparation.

Studies and Notes in Philology and Literature (Modern Language Departments): yearly. Vols. I–V issued. Vols. VI and VII in preparation.

Harvard Historical Studies: published under the direction of the Department of History and Government, from the income of the Henry Warren Torrey Fund. Vols. I–VIII issued.

Quarterly Journal of Economics: in its fourteenth year.

Annals of the Observatory of Harvard College: thirty-six volumes issued.

Contributions from the Cryptogamic Laboratory: forty-one numbers issued.

Publications of the Museum of Comparative Zoölogy: — Bulletin, thirty-four volumes issued, including Geology; Memoirs by Professors and Assistants, twenty-two volumes issued.

Contributions from the Zoölogical Laboratory: one hundred and five numbers issued. (Some of the contributions are also contained in the Museum Bulletin.)

Publications of the Peabody Museum of American Archaeology and Ethnology: — Annual Reports, thirty-two numbers issued; Papers, six numbers issued; Memoirs, five numbers issued.

The Harvard Graduates' Magazine, issued quarterly, and now in its eighth year, gives a record of the current life and work of the University, biographical and bibliographical data regarding Graduates, besides articles on other matters of general interest.

CLUBS.

Important work is done by students in Clubs which exist in more or less close connection with the several Departments of study, and meet frequently. These organizations, concerning which detailed information is given in the Departmental Pamphlets or may be obtained from instructors include the following: —

Sanskrit Conference: fortnightly in the second half-year.
Classical Club: fortnightly.
Modern Language Conference: fortnightly.
Deutscher Verein: fortnightly.
Cercle Francais: fortnightly.
Philosophical Conference: monthly.
Harvard Pedagogical Club: fortnightly.
Harvard Memorial Society.
Harvard Folk-Lore Society.
Harvard Physical Club: twice in three weeks.
Harvard Chemical Club: fortnightly.
Boylston Chemical Society: fortnightly.
Botanical Conference: fortnightly.
Botanical Club: fortnightly.
Zoölogical Club: weekly.
Geological Conference: weekly.
Harvard Natural History Society: bi-monthly.
Harvard Engineering Society: monthly.

To these are to be added the Semitic Conference, the Classical Seminary, the Mathematical Conference, the Physical Colloquium, and the Geological Conference (see Announcement), which have something of the character of clubs.

Besides the above named clubs, existing for purposes of special study and discussion, there are organized in the University many societies having religious, ethical, political, literary, musical, and social objects. The Graduates' Club, maintained by students in the Graduate School, may be especially mentioned. Its circular may be obtained on application.

THE UNIVERSITY CHAPEL.

BOARD OF PREACHERS.

Francis Greenwood Peabody, D.D., *Plummer Professor of Christian Morals.*

William Jewett Tucker, D.D., LL.D.
Charles Cuthbert Hall, D.D.
Endicott Peabody, LL.M., S.T.B.
Paul Revere Frothingham, A.M., S.T.B.
Robert MacDonald, A.M., S.T.B.

Preachers to the University for the year 1899–1900.

There have also served on this Board since its foundation in 1886: —

Edward Everett Hale, D.D.
Alexander McKenzie, D.D.
Theodore C. Williams, S.T.B.
George A. Gordon, D.D.
Phillips Brooks, D.D.
William Lawrence, D.D.
Brooke Herford, D.D.
Henry Van Dyke, D.D.
Lyman Abbott, D.D.
Charles Carroll Everett, D.D.
Washington Gladden, D.D.
Leighton Parks, D.D.
J. Estlin Carpenter, A.M.
E. Winchester Donald, D.D.
Samuel McChord Crothers, D.D.
Simon J. McPherson, D.D.
John H. Vincent, D.D.
Samuel D. McConnell, D.D.
Philip S. Moxom, D.D.
William Wallace Fenn, S.T.B.
George Harris, D.D.
George Hodges, D.D.
William DeWitt Hyde, D.D.
William H. P. Faunce, D.D.

On May 10, 1886, a vote was passed by the President and Fellows "That five preachers to the University be annually appointed by the President and Fellows, with the concurrence of the Board of Overseers, who, in conjunction with the Plummer Professor of Christian Morals, shall arrange and conduct the religious services of the University." The Board of Overseers concurred in this vote on May 12, 1886, and in 1892 it was incorporated in the Statutes of the University.

On June 14, 1886, on the unanimous recommendation of the Preachers and the Plummer Professor, the President and Fellows voted "That the statute numbered 15, concerning religious exercises, be amended by striking out the clause, "at which the attendance of the students is required"; and on June 16 the Board of Overseers concurred in this vote. Attendance at the religious services of the University was thus, by the advice of those who conduct these services, made wholly voluntary.

The services in the University Chapel are directed by the Board of Preachers as follows: Each conducts daily morning prayers for about

three weeks in each half-year, and each preaches on four Sunday evenings. The Preacher conducting morning prayers is in attendance every morning during his term of duty at Wadsworth House 1, and is at the immediate service of any student who may desire to consult him. On Thursday afternoons from November till May, vesper services are held in the University Chapel. These services are brief, largely musical, and with an address from one of the Preachers. Services on Sunday evenings are conducted by preachers of various communions by invitation of the Board of Preachers. The following invited preachers, in addition to the regularly appointed Board, conducted services during the year 1898–99 : —

Rev. Edward Everett Hale, D.D., of Boston.
Rev. Alexander McKenzie, D.D., of Cambridge.
Rev. J. H. Ecob, D.D., of Albany.
Rev. Samuel A. Eliot, D.D., of Cambridge.
Rev. E. Winchester Donald, D.D., of Boston.
Rev. Thomas R. Slicer, of New York.
Rev. Francis E. Clark, D.D., of Auburndale.
Rev. Theodore C. Williams, of Boston.
Rev. Paul Revere Frothingham, of New Bedford.
Rev. Professor William Cunningham, D.D., of Trinity College, Cambridge, England.
Rev. Lyman Abbott, D.D., of Brooklyn.
Rev. Professor Edward Hale, of Cambridge.
Rev. Professor W. A. Brown, Union Theological Seminary, New York.
Rt. Rev. William Lawrence, D.D., of Boston.

The Preachers are glad to have their attention called to any cases of special need where they may be useful, or to any better methods of serving the moral and religious interests of the University. General correspondence for the current academic year should be addressed to the Plummer Professor, though any Preacher will gladly consider such questions as may be more appropriately addressed to him.

The Phillips Brooks House, a memorial of the late Bishop of Massachusetts, now provides a well-equipped building for the accommodation and work of the Religious Societies of the University and for the encouragement of philanthropic activity on the part of students.

In addition to the opportunities for worship in Appleton Chapel, seats are provided for students, at the expense of the College, in the churches of the different denominations in Cambridge. St. John's Memorial Chapel of the Episcopal Theological School having been erected for the especial accommodation of Harvard students is free to them.

THE UNIVERSITY LIBRARY.

COUNCIL.

CHARLES WILLIAM ELIOT, LL.D., *President.*
WILLIAM COOLIDGE LANE, A.B., *Librarian.*
CHARLES ELIOT NORTON, LL.D., *Professor of the History of Art, Emeritus.*
CHARLES FRANKLIN DUNBAR, LL.D., *Professor of Political Economy.*
CRAWFORD HOWELL TOY, LL.D., *Professor of Hebrew.*
GEORGE LINCOLN GOODALE, LL.D., *Professor of Botany.*
MORRIS HICKY MORGAN, LL.D., *Professor of Classical Philology.*
GEORGE LYMAN KITTREDGE, A.B., *Professor of English.*

COLLEGE LIBRARY.

WILLIAM COOLIDGE LANE, A.B., LIBRARIAN, and *Keeper of the University Records.*
WILLIAM HOPKINS TILLINGHAST, A.B., *Assistant Librarian.*
THOMAS J KIERNAN, A.M., *Superintendent of Circulation.*
ALFRED CLAGHORN POTTER, A.B., *Ordering Department.*
FRANK CARNEY, *Shelf Department.*
NATHANIEL DANA CARLILE HODGES, A.B., *Shelf Department.*
WALTER BENJAMIN BRIGGS, *Superintendent of Reading Room.*
THOMAS FRANKLIN CURRIER, A.B., *Assistant in Catalogue Department.*
PERCY HARRINGTON TUFTS, A.B., *Assistant in Ordering Department.*

JAMES ATKINS NOYES, PH.B., A.B., *Editor of the Quinquennial Catalogue.*
WILLIAM GARROTT BROWN, A.M., *Deputy Keeper of the University Records.*
MALCOLM STORER, M.D., *Curator of Coins.*

The College Library in Gore Hall is for the use of the whole University. All students who have given bonds may take out books, three volumes at a time, and may keep them one month. Officers of the University have direct access to the shelves in all parts of the library, and students engaged

in advanced work, upon recommendation by their instructors, are allowed access to those parts of the collection with which they are occupied. All students have the direct use of about 19,400 volumes in the reading room and the adjoining rooms. Of these 3300 are bound periodicals, 4100, miscellaneous reference books, 3700, government documents, and about 8300 are books withdrawn from general circulation at the request of instructors and "reserved" on shelves in the reading room for use in connection with the courses of instruction. Students who leave Cambridge for an absence of more than one week must first return all borrowed books.

The College Library is open every week-day for the delivery of books, from 9 A.M. to 5.30 P.M., except Thanksgiving day, Christmas day, the Twenty-second of February, Patriots' day, Memorial day, and the Fourth of July. The Reading Room is open from 9 A.M. to 10 P.M. During the summer vacation the library closes at 5.30 P.M., on Saturday at 1 P.M. On Sundays during term time the Library is open, for readers only, from 1 to 5.30 P.M.

The College Library may be consulted by anyone, when properly introduced, whether connected with the University or not. The privilege of borrowing books is also granted, under special regulations, to persons not connected with the University. *Blanks for making applications for such use may be had of the Librarian.*

SPECIAL LIBRARIES.

In addition to the College Library in Gore Hall, the University Library embraces the libraries of the several departments of the University, which are classed as Departmental Libraries, and the libraries maintained in the various branches of study pursued under the direction of the Faculty of Arts and Sciences, which are known as Laboratory and Class-Room Libraries.

The Departmental Libraries are in charge of the Deans and Directors of the several departments, or of Librarians named in the lists of officers of the departments. The Laboratory and Class-Room Libraries, with the names of their librarians, are enumerated (with some of the Departmental Libraries) on pages 426, 427.

Persons entitled to use the College Library can have access to the Departmental Libraries by applying to the Superintendent of Circulation at Gore Hall; but such libraries are primarily for the special use of the schools and departments, and are placed in the buildings or rooms belonging to such schools and departments.

The several libraries now contain about the following numbers of bound volumes: —

Gore Hall	379,000
Lawrence Scientific School (Engineering Library)	4,900
Bussey Institution (Jamaica Plain)	4,000
Phillips Library (Observatory)	9,400
Herbarium Library, Botanic Garden	7,600
Law School	50,400
Divinity School	29,500
Medical School (Boston)	2,200
Museum of Comparative Zoölogy	32,300
Peabody Museum	2,000
Arnold Arboretum	6,700
Seven laboratory and sixteen class-room libraries	20,000
	548,000

The collection of pamphlets and maps in the College Library is very large, and is estimated to be equal in number to the collection of bound volumes. The departmental libraries have also considerable numbers of pamphlet monographs on subjects connected with their specialties; and these are not included in the count of volumes. The College Library has also a collection of coins.

The catalogue of the Gore Hall Collection, including pamphlets, is on cards, accessible to the public, and consists of two parts, the one arranged by authors, the other by subjects. Printed strips of titles added to all the libraries are issued two or three times a week; and they are posted in Gore Hall and in the departmental libraries. These titles are also inserted in bound volumes of slips, kept in the Reading Room. A series of "Bibliographical Contributions," is in course of publication. Fifty-three of such publications have already been issued. More extensive bibliographical works constitute another series, "Special Publications," of which Scudder's "Catalogue of Scientific Serials" (1633–1876, 8vo, pp. 370) makes No. 1, published in 1879, and "An Index to the Subject Catalogue of Harvard College Library" makes No. 2, published in 1891. There has also been issued a Catalogue of the Gray Collection of Engravings (4to, 1869); this collection is in the Fogg Museum of Art.

The Librarian has the custody of the Archives of the University, as well as of the University Collection, which includes printed material of all sorts, illustrating the history of the College and University.

LABORATORIES.

THE CHEMICAL LABORATORY.

OFFICERS.

Henry Barker Hill, A.M., Director, and *Professor of Chemistry.*
Charles Loring Jackson, A.M., *Erving Professor of Chemistry.*
Charles Robert Sanger, Ph.D., *Assistant Professor of Chemistry.*
Theodore William Richards, Ph.D., *Assistant Professor of Chemistry.*
Joseph Torrey, Jr., Ph.D., *Instructor in Chemistry.*
Otis Fisher Black, A.M., *Assistant in General Chemistry.*
Alvin Sawyer Wheeler, A.M., *Assistant in Organic Chemistry.*
Daniel Francis Calhane, A.M., *Austin Teaching Fellow in Descriptive Chemistry.*
Gilbert Newton Lewis, Ph.D., *Instructor in Physical Chemistry.*
Benjamin Shores Merigold, A.M., *Assistant in Analytical Chemistry.*
Wallace Patten Cohoe, A.M., *Assistant in Qualitative Analysis.*
Lawrence Joseph Henderson, A.B., *Assistant in Descriptive Chemistry.*
Kenneth Lamartine Mark, A.B., *Assistant in Descriptive Chemistry.*
Michael Xavier Sullivan, A.B., *Assistant in Descriptive Chemistry.*
Lynn Staley Beals, *Assistant in Descriptive Chemistry.*
Frederic Bonnet, Jr., S.B., *Assistant in Qualitative Analysis.*
Walter Gustavus Waitt, *Assistant in Qualitative Analysis.*
Ray Pritchard Ells, *Assistant in Descriptive Chemistry.*
Simon Everard Williams, Ph.G., *Assistant in Descriptive Chemistry.*

The Division of Chemistry of the Faculty of Arts and Sciences occupies the whole of Boylston Hall.

Boylston Hall was erected in 1857 with a fund bequeathed by the late Ward Nicholas Boylston, which was subsequently largely increased by subscription. The hall was enlarged by the addition of a third story in 1870, and the accommodations were still further extended in 1891 and 1895. Besides several private laboratories and preparation rooms, the building contains seven large laboratories for students. A room on the upper story with one hundred and ninety-six places is especially devoted to qualitative and descriptive work. A large laboratory at the west end is fitted with all the modern appliances for the study of organic

chemistry; there is also a room for work in advanced quantitative analysis. On the lower story a laboratory with forty-four places is reserved wholly for quantitative work, and connected with it is a laboratory, with twelve desks, especially fitted up for advanced work in inorganic chemistry. On the same story are two rooms devoted to work in physical chemistry; and further a large laboratory with ninety-six places for the most elementary class. In the basement is a laboratory for work in descriptive chemistry with two hundred and thirty-two places. On the second story are three lecture-rooms, a reading-room, departmental library, and a chemical museum.

All the courses of instruction in Chemistry to students of Harvard College, of the Lawrence Scientific School, and of the Graduate School, are given in Boylston Hall. The laboratories are open to Special Students to follow any line of chemical investigation. The facilities for research are unusually great.

THE JEFFERSON PHYSICAL LABORATORY.

OFFICERS.

John Trowbridge, S.D., Director, and *Rumford Professor and Lecturer on the Application of Science to the Useful Arts.*

Edwin Herbert Hall, Ph.D., *Professor of Physics.*

Benjamin Osgood Peirce, Ph.D., *Hollis Professor of Mathematics and Natural Philosophy.*

Wallace Clement Sabine, A.M., *Assistant Professor of Physics.*

Harrison Hitchcock Brown, A.M., *Assistant.*

Thomas Calvin McKay, A.M., *Assistant.*

William Edward McElfresh, A.M., *Assistant.*

Theodore Lyman, A.M., *Assistant.*

Charles Hamilton Ayres, Jr., A.M., *Assistant.*

George W. Thompson, *Mechanician.*

In 1881, Thomas Jefferson Coolidge, of Boston, of the Class of 1850, Minister to France 1888–96, gave $115,000 to the College for a new Physical Laboratory, on condition that $75,000 should be raised by subscription and the income appropriated to its support. The building was finished in Oct., 1884, and is called the Jefferson Physical Labora-

tory. All the instruction in Physics, by recitations, lectures, and experimental work, to students of Harvard College, of the Lawrence Scientific School, and of the Graduate School, is given in this building, which accommodates the various physical cabinets. The building is four stories high, if the basement is included. In the eastern wing the whole height is divided between a large lecture-room below, and the great laboratory above. In the central and western portions of the building are three recitation-rooms for sections of forty or less; but the principal part of the central and western portions is broken up into a large number of small rooms, where the professors, assistants, and advanced students can pursue their separate investigations, and be secured against intrusion, or any disturbance of their instruments. In the basement and first story, stone tables, each supported by its own column of masonry, and without contact with the floors, furnish firm support for these instruments. In the centre of the western wing a large rectangular tower stands on an independent foundation, and is isolated from the surrounding rooms. It is designed for investigations which demand extraordinary stability, or a great height: as in Foucault's pendulum-experiment. Small openings have been left in the brick partitions which divide the length of the building, by means of which a long path is available for such experiments as that on the velocity of light. In the western wing, iron nails and pipes which would disturb delicate experiments in magnetism, were excluded in the construction of the building. In the bottom of the tower is a small underground room which may be used for experiments requiring a constant temperature.

A room is devoted to the accurate measurement of electrical resistances and is provided with standard coils.

A comparator for the measurement and comparison of standards of length occupies a room in the basement of the Laboratory.

The photographic room adjoins a large space on the fourth floor, which contains the rooms especially arranged for spectrum analysis. There are four principal laboratory rooms. One of these is 40x60 feet and is devoted to elementary laboratory instruction. A time wire from the Observatory is led to this room. The laboratory for advanced instruction in electricity is in the basement and is provided with instruments of the latest type. A machine room is supplied with power from an electric motor. In this room is a milling machine, a large machine lathe, a smaller lathe, and other mechanical appliances for designing and making apparatus. The machine room is under the charge of a skilled mechanician. Power can also be obtained from a twenty-five-horse-power engine which is placed in a house outside of the Laboratory.

MUSEUMS.

In the University Museum building are the Museum of Comparative Zoölogy, the Botanical Museum, the Mineralogical Museum, the Natural History Laboratories, and the Peabody Museum of American Archaeology and Ethnology. The Semitic Museum is for the present placed in the building of the Peabody Museum.

The entrance to the Museum of Comparative Zoölogy and the Peabody Museum is from Divinity Avenue. The Natural History Laboratories and the Botanical and Mineralogical Museums are entered from Oxford Street.

The Museum of Comparative Zoölogy consists of the North wing of the University Museum quadrangle (60 x 200 feet). The Natural History Laboratories are in the N. W. corner piece of the same quadrangle (95 x 75 feet), and in the adjoining sections of the central part of the University Museum facing Oxford Street.

The Botanical Museum occupies the central section of the University Museum, together with one-third of the southern sections.

The Mineralogical Museum occupies the southern section of the Oxford Street façade (60 x 60 feet).

The S. W. corner piece will contain large Lecture Rooms and Laboratories for the Natural History Departments, and its Exhibition Rooms will connect the Oxford Street façade of the Museum with the Peabody Museum, which, when completed, will form the South wing of the University Museum building.

THE MUSEUM OF COMPARATIVE ZOÖLOGY.

FACULTY.

Charles William Eliot, LL.D., President.

———— ————, Director and Curator.

George Lincoln Goodale, M.D., LL.D. } *Committee on the*
Henry Pickering Walcott, A.B., M.D. } *Museum.*

Alexander Agassiz, LL.D., *Secretary.*

OFFICERS.

William McMichael Woodworth, Ph.D., *Assistant in charge of the Museum.*

William Morris Davis, M.E., *Sturgis-Hooper Professor of Geology.*

Walter Faxon, S.D., *Assistant in charge of Mollusks and Crustacea.*

Samuel Garman, *Assistant in Herpetology and Ichthyology.*

William Brewster, *Assistant in Ornithology and Mammalogy.*

Alpheus Hyatt, S.B., *Assistant in Invertebrate Palaeontology.*

Samuel Henshaw, *Assistant in Entomology*, and *Librarian.*

Alfred Goldsborough Mayer, Ph.D., *Assistant in charge of Echinoderms, Polyps, etc.*

Charles Rochester Eastman, Ph.D., *Assistant in Vertebrate Palaeontology.*

Frances Mary Slack, *Librarian Emerita.*

Magnus Westergren, *Artist.*

The Museum of Comparative Zoölogy was founded in 1859 by private subscription with the assistance of the State of Massachusetts. In 1876 the property in the hands of the Trustees was transferred to the President and Fellows of Harvard College.

The Museum is under the management of a Faculty, who nominate the Curator and the Sturgis-Hooper Professor, and appoint the Assistants.

The Curator is charged with the direction of the scientific and educational interests of the Museum, as well as of its relations to the public.

The Exhibition Rooms open to the public are the Synoptic Room, the rooms containing the systematic collections of Mammals, Birds, Reptiles, Fishes, Mollusks, Crustaceans and Insects, Radiates, Sponges and Protozoans, also the rooms devoted to the faunal collections of Europe, of North and South America, the Indo-Asiatic, the African, the Australian Realms, and the Atlantic and Pacific Rooms and the Rooms devoted to the Quaternary, Tertiary and Mesozoic fossils. The collections, so far as arranged, are open to visitors every week-day, from 9 A.M. till 5 P.M., and on Sunday, from 1 P.M. till 5 P.M. Entrance on the south side of the North wing.

The publications of the Museum consist of an annual Report (1861–1899), of an octavo Bulletin (vols. i.–xxxv.), and of Memoirs in quarto (vols. i.–xxiv.). The Bulletin and Memoirs are devoted to the publication of original work by the Professors and Assistants of the Museum, of investigations carried on by students and others in the different laboratories of Natural History, and of work by specialists based upon the Museum collections.

The Library of the Museum is on the second floor of the N. W. corner of the Museum. It contains over 24,000 volumes, exclusive of 3000 volumes of pamphlets, and of the Whitney Library containing about 5000 volumes and nearly 5000 pamphlets, making the total number of volumes 32,300 and about 23,300 pamphlets. The Library is open from 9 to 1 and from 2 to 5.

LABORATORIES OF ZOÖLOGY, PALAEONTOLOGY, GEOLOGY, AND PHYSICAL GEOGRAPHY.

The courses of instruction in Geology, Physical Geography and Meteorology, Palaeontology, Zoölogy, Microscopical Anatomy, Embryology, are given in the laboratories (entrance on Oxford Street) connected with the Museum.

The Instructors and Assistants of the Museum also receive Special Students in their respective departments.

Two of the tables of the U. S. Fish Commission at Wood's Hole are at the disposal of the Director of the Museum, to whom application should be made before the first of May. Candidates should specify their qualifications and the work they intend to carry out.

The income of the Humboldt Fund (about $400) is applied, with the advice of the Faculty of the Museum, towards the maintenance of one or more persons engaged in study at the Museum, or at the Wood's Hole Fish Commission Station. This fund, now amounting to about eight thousand dollars, was given to the Trustees of the Museum of Comparative Zoölogy by the Boston Society of Natural History in November 1869. It was derived from the proceeds of a celebration, held in Boston in that year, of the centennial anniversary of the birth of Alexander von Humboldt, augmented by a special subscription and by money received from the sale of an address delivered on the occasion of the celebration by Professor Louis Agassiz. Its income is applied, under the direction of the Faculty of the Museum of Comparative Zoölogy, towards the maintenance of one or more persons engaged in the study of Zoölogy or of other branches of Natural History.

The Virginia Barret Gibbs Scholarship, of the value of $250, is assigned annually with the approval of the Faculty of the Museum at the recommendation of the Professors of Zoölogy and of Comparative Anatomy in Harvard University "in supporting or assisting to support one or more students who may have shown decided talents in Zoölogy and preferably in the direction of Marine Zoölogy."

THE BOTANICAL MUSEUM.

OFFICERS.

George Lincoln Goodale, M.D., LL.D., *Fisher Professor of Natural History.*
William Gilson Farlow, M.D., LL.D., *Professor of Cryptogamic Botany.*
Roland Thaxter, Ph.D., *Assistant Professor of Cryptogamic Botany.*
Arthur Bliss Seymour, S.M., *Assistant in Cryptogamic Herbarium.*
James Brown Dandeno, A.M., *Assistant in Botanical Museum.*
George Richard Lyman, A.M., *Assistant in Botany.*
Edgar William Olive, S.M., A.M., *Instructor in Botany.*
Oakes Ames, A.M., *Assistant in Botany.*
James Birch Rorer, A.B., *Assistant in Cryptogamic Botany.*
Rudolph Blaschka, *Artist-naturalist.*

The collections at present accessible to the public are on the third floor of the central section of the University Museum and on the landing of the first floor. They are designed to illustrate the principal systematic, biological, and economic relations of plants. The large and increasing Ware Collection of glass models of flowers, prepared by the artists Leopold and Rudolph Blaschka of Germany, occupies the large exhibition room. Contiguous rooms contain collections of economic products, and on the landing of the first floor is to be found a collection of Cryptogams.

LABORATORIES OF CRYPTOGAMIC AND PHANEROGAMIC BOTANY.

The Cryptogamic Laboratories occupy the whole of the fifth floor (60 x 120 feet). Here is also kept the extensive Herbarium of Algae, Fungi, and Lichens. (Not open to the public.)

The Laboratories of Phanerogamic Botany are on the second floor, and are supplemented by private workrooms in other parts of the botanical section. In the basement is stored the large collection of Fossil plants, now in process of arrangement.

The N. C. Nash Botanical Lecture-room, the gift of a graduate in memory of his father, is on the first floor of the Museum.

THE MINERALOGICAL MUSEUM.

OFFICERS.

John Eliot Wolff, Ph.D., Curator, and *Professor of Petrography and Mineralogy.*
Charles Loring Jackson, A.M., *Erving Professor of Chemistry.*
Charles Palache, Ph.D., *Instructor in Mineralogy and Petrography.*
Arthur Starr Eakle, Ph.D., *Instructor in Mineralogy.*

The mineralogical section of the University Museum, built in 1890–91 with a fund of about $50,000, raised wholly by subscription, forms the southern end of the University Museum, so far as at present completed. Entrance is by the south door on Oxford Street.

The exhibition room and gallery occupy the third and fourth floors and are open to the public on Wednesday and Sunday afternoons, from 1 to 5, and Saturday from 9 to 5.

The main mineralogical collections of the University are deposited here; they contain on the ground floor and gallery the large systematic collection with special features and collections, such as the J. Lawrence Smith collection of meteorites, the William Sturgis Bigelow agates, the Hamlin collection of tourmalines, and many unique specimens presented by James A. Garland and others.

MINERALOGICAL LABORATORIES.

The Laboratories of Mineralogy and Petrography occupy the second floor, first floor, and basement, and contain a laboratory for advanced crystallographic investigation and optical mineralogy on the second floor; the large lecture-room, general laboratory for elementary mineralogy and blow-pipe analysis, special laboratory and library on the first floor, and in the basement a chemical laboratory equipped for mineral and rock analysis.

The courses in mineralogy, crystallography, and petrography are given in these laboratories, where the instructors also receive properly qualified students who wish to follow special lines of mineralogical investigation.

THE SEMITIC MUSEUM.

CURATOR.

David Gordon Lyon, Ph.D., *Hollis Professor of Divinity.*

The Semitic Museum was founded in 1889 by Jacob H. Schiff, Esq., and was opened on May 13, 1891. It occupies temporarily a gallery in the new section of the Peabody Museum building, and is open to students and the public daily, except Sundays and holidays, from 9 A.M. till 5 P.M. The object of the Museum is to gather such materials as shall illustrate the Semitic instruction given in the University, provide students and other specialists with the means of original research, and give to the general visitor as complete a view as possible of the products of Semitic art and archaeology.

The collection contains manuscripts, coins, photographs, Babylonian-Assyrian seals, cuneiform tablets of clay and stone, Phoenician glassware, numerous objects from Palestine, and a large number of casts of the finest of the Semitic monuments in the European museums. The objects are provided with descriptive labels. Beginning on the left of the door, the chronological order has been followed, where the size of the objects and the date of arrival have not hindered. The high cases in the room are largely filled with casts of Assyrian monuments, chiefly from the palaces of Assurnazirpal and Assurbanipal, ninth and seventh centuries B.C. The colored casts of monuments from the Babylonian ruin called Tello and from the ruins of the Persian Susa are among the finest in the collection. There are also casts of Hittite bas-reliefs and of Hittite and Persian inscriptions. There are twenty-five Mohammedan mortuary stones from Egypt with inscriptions in the Cufic character. A few of the manuscripts belonging to the Museum, Syriac, Hebrew and Arabic, are exhibited in the railing case. The oldest is a Syriac manuscript of the Gospels written in 1207. Among the Hebrew manuscripts are a roll of the Law and rolls of the Prophets. Some of the latter are from Arabia and contain besides the Hebrew text a translation into Arabic written in Hebrew characters. The objects from Palestine consist mainly of geological and vegetable specimens, birds, animals, coins, and articles illustrating modern life in that land. The collection was gathered by Rev. Dr. Selah Merrill, and is owned by the Harvard Divinity School. The coins in this collection number some 700, struck in various cities of Palestine or under Roman rulers of the land. Of the many hundred photographs which the Museum possesses, a few, chiefly representing

Palestinian scenery, are on exhibition. The Museum owns many other objects which cannot now be exhibited for lack of space. A great increase in the number has been made possible by friends who contributed to this end in 1899 nearly $20,000. Ampler accommodations are now provided for through an additional gift from Mr. Schiff of $50,000 for the erection of a Semitic Building. It is hoped that this building may be ready for occupancy by the academic year 1901–02.

THE WILLIAM HAYES FOGG ART MUSEUM.

DIRECTOR.

Charles Herbert Moore, A.M., *Professor of Art.*

The William Hayes Fogg Art Museum was founded by Mrs. Elizabeth Fogg of New York in memory of her husband, whose name it bears. Mrs. Fogg bequeathed to the President and Fellows for this purpose the sum of $220,000. Of this amount $150,000 was expended on the handsome fire-proof building which was completed in 1895 and is situated in the College Yard facing on Broadway. The building is of two stories with a large lecture room, having a seating capacity of about five hundred, attached. On the ground floor is a large hall for casts with five smaller rooms for casts and other objects. The upper floor has a large gallery and four smaller rooms for the exhibition of works of art and for administration. The collections thus far consist of casts from important works in sculpture of the ancient, mediaeval, and Renaissance epochs, a classified collection of electrotypes from Greek and Roman coins, a small series of Greek vases, and a large and growing collection of photographs of works of art of all epochs and countries, including architecture, sculpture, and painting. These photographs are conveniently classified and catalogued; and are at all times accessible to members of the University and other visitors.

In the larger east room on the upper floor is deposited the Gray Collection of Engravings. This important and very valuable collection was bequeathed to Harvard College, with provision for its increase and maintainance, by the Hon. Francis Calley Gray, LL.D., of the Class of 1809. It was first deposited in Gore Hall under the care of Mr. Louis Thies, who prepared and published an elaborate Catalogue which forms a quarto volume of 530 pages. On the death of Mr. Thies, Dr. Ezra Abbott became its custodian; and later the Corporation appointed Mr. (now Professor) George H. Palmer its curator. On the completion of

the building of the Boston Museum of Fine Arts (the College having as yet no suitable place for its safe keeping and administration), it was loaned, for a term of seven years, to the Trustees of that institution and removed to Boston. Its first custodian in Boston was Mr. Erastus Brainerd, who was succeeded by Mr. E. H. Greenleaf. Later, it passed into the able curatorship of Mr. S. R. Koehler. The loan to the Trustees of the Boston Museum of Fine Arts was twice renewed, and in the autumn of 1897 the Corporation caused it to be returned to Cambridge and deposited in its present safe and convenient quarters under the care of the Director of the Museum — where it is always accessible to members of the University and to the public.

The Fogg Museum also contains the Randall Collection of Engravings which was bequeathed to Harvard College by the late John Witt Randall, A.M., M.D. of the Class of 1834. This collection contains about twenty thousand prints and drawings; and is accessible at all times under the rules and regulations which apply to the Gray Collection.

In addition the Museum has lately acquired, as an indefinite loan, six original works of art as follows: A Greek marble statue of Meleager, found near Rome in 1895 (an example of the finest Greek sculpture of the 4th century B.C.); a Greco-Roman sarcophagus relief in marble representing a Battle of Amazons; a small Aphrodite head in marble; a Florentine *Tabernacolo* of the 15th century in tempera; an Adoration of the Magi of the school of Ferrara (also of the 15th century); and a portrait of a Procurator of St. Mark, a Venetian oil painting of the 16th century, having the characteristics of the work of Tintoretto.

The Museum is open daily from 9 until 5 o'clock, and from 7 until 9 in the evening. On Sundays it is open from 1 until 5 in the afternoon.

In addition to the Museums above named, the University possesses Museums at the Medical and the Dental Schools and at the School of Veterinary Medicine.

BOTANIC GARDEN AND HERBARIUM.

THE BOTANIC GARDEN.

OFFICERS.

George Lincoln Goodale, M.D., LL.D., Director, and *Fisher Professor of Natural History.*
Oakes Ames, A.M., *Assistant Director of the Botanic Garden.*
Robert Cameron, *Head Gardener.*

The Botanic Garden, founded in 1807, occupies about seven acres of land at the corner of Linnæan and Garden Streets, Cambridge. More than five thousand species of flowering plants are cultivated for educational and scientific purposes.

The range of greenhouses comprises fourteen divisions assigned respectively to: — (1) Desert plants for illustrations in ecology. (2) Cactus conservatory. (3) Economic plants. (4) Palms and their allies. (5) Mexican plants and Ferns. (6) Potting shed. (7) Tropical orchids, aroids, etc. (8) Australasian plants. (9) Winter blooming roses and other decorative plants. (10), (11) Devoted to experimental work in vegetable physiology. (12) Propagating house. (13) Potting shed. (14) Devoted to the more common classes of flowering plants, and for raising Herbaceous plants.

The space at the north-western part of the Garden is devoted to an exhibition of a large number of our North American species, with special reference to their morphology. The ground below the terrace is filled with illustrations of the Orders and principal Genera of the plants of the United States, together with species from the Old World for comparison.

The grounds and greenhouses are open to the public daily, from sunrise to sunset.

To students properly qualified, specimens of flowers and living plants are freely furnished, and facilities are offered in the laboratories in the Garden, for pursuing investigations in Morphology. Under certain restrictions, students are supplied with all necessary appliances for con-

ducting experiments in Vegetable Physiology and its application to practical questions in horticulture.

From the first week in July until the second week in August, regular instruction in Botany is given at the Botanic Garden, in connection with the Summer School of the Faculty of Arts and Sciences (see pp. 406–411).

THE GRAY HERBARIUM.

OFFICERS.

Benjamin Lincoln Robinson, Ph.D., Curator.
Cyrus Gurnsey Pringle, *Collector.*
Merritt Lyndon Fernald, S.B., *Assistant.*
Mary A. Day, *Librarian.*

The Gray Herbarium occupies a building in the Botanic Garden The collection, presented to Harvard University in 1864 by the late Professor Asa Gray, now contains over three hundred thousand sheets of mounted specimens and is the result of more than sixty years of continuous growth. It embraces all orders of flowering plants, ferns, and fern-allies, while the bryophytes, fungi, lichens, and algae have now been transferred to the Cryptogamic Herbarium in the Botanical Division of the University Museum. The Gray Herbarium is rich in type specimens of species and varieties, in standard and rare phaenogamic *exsiccati*, and in the possession of the greater part of the specimens which have been critically studied in the preparation of the "Synoptical Flora of North America."

The Herbarium may be consulted, under supervision of the staff, by advanced students and other properly qualified persons. Visiting specialists receive such facilities for work as can be given without interrupting the regular duties of the staff.

The Library of the Herbarium, now including more than twelve thousand carefully selected volumes and pamphlets, is open for consultation to all persons interested in Botany.

The scientific publications of the Herbarium at present embrace the following classes of work: I. The continuation of the "Synoptical Flora of North America." II. The issue from time to time of "Contributions from the Gray Herbarium of Harvard University," a series of technical papers devoted chiefly to the characterization of new species and monographing of genera. III. The preparation of lesser articles, both technical and popular, published in various scientific journals.

THE BUSSEY INSTITUTION.

The School of Agriculture and Horticulture, known as the Bussey Institution, was established in execution of trusts created by the will of Benjamin Bussey. It gives systematic instruction in Agriculture, in Useful and Ornamental Gardening, and in Chemistry and Natural History as applied to these arts.

It is, in general, meant for young men who intend to become practical farmers, gardeners, florists, or landscape gardeners; as well as for those who will be called upon to manage large estates, or who wish to qualify themselves to be overseers or superintendents of farms, country seats, parks, towns, highways, or public institutions. It may serve also for the training of investigators and teachers of agricultural science, and in special cases as a school for the methodical education of young men fond of country life or interested in natural history.

The degree of Bachelor of Agricultural Science may be attained by students in the School.

The Bussey Institution is situated at the outer edge of Jamaica Plain, Massachusetts, about five miles southwest of the centre of Boston, and close to the Forest Hills station on the Boston and Providence Railroad. Although somewhat removed from the other departments of the University, it is near enough to Cambridge to enable the student, if he please, to attend a great variety of collateral instruction there given, and to make use of the College Library and the rich scientific collections of the University. The position of the School is in some part advantageous in that it helps to maintain the spirit and atmosphere proper to a School of Agriculture and insures to its younger students mental independence, freedom from distractions, and opportunity to devote themselves seriously to their chosen studies. Students may live either in the immediate vicinity of the School, or in Boston proper, or in some one of the villages upon the lines of the adjacent railways.

INSTRUCTORS.

Edmund Hersey, *Instructor in Farming*, and *Superintendent of the Bussey Farm.*

Francis Humphreys Storer, S.B., A.M., Dean, and *Professor of Agricultural Chemistry.*

Benjamin Marston Watson, A.B., *Instructor in Horticulture.*

Elisha Wilson Morse, B.A.S., *Instructor in Natural History.*

Winfred Waite Braman, S.B., *Assistant in Chemistry.*

James Reverdy Stewart, *Assistant in Applied Zoölogy.*

Charles Sprague Sargent, A.B., *Director of the Arnold Arboretum.*

THE ARNOLD ARBORETUM.

The Arnold Arboretum was founded in 1872, by the trustees under the will of JAMES ARNOLD, of New Bedford, for the purpose of scientific research and experiment in Arboriculture, Forestry, and Dendrology, and as a Museum of trees and shrubs suited to the climate of Massachusetts. The Arboretum occupies a portion of the Bussey Farm in West Roxbury, 220 acres in extent, and under a special arrangement with the City of Boston, is open to the public every day in the year from sunrise to sunset. The living collections are supplemented by an Herbarium, Museum, and Library.

OFFICERS.

CHARLES SPRAGUE SARGENT, A.B., DIRECTOR, and *Arnold Professor of Arboriculture.*

CHARLES EDWARD FAXON, S.B., *Assistant, in charge of Herbarium and Museum.*

JACKSON DAWSON, *Superintendent.*

Any one properly qualified to pursue the study of practical arboriculture or forestry may be admitted to the Arboretum as a student. Such students will be permitted to take part in the work carried on in the Arboretum as well as to make use of its Library. They will also receive from the officers of the Arboretum such assistance and advice in the study of any branch of Arboriculture or Dendrology as can be rendered without interference with current work. In order to study with advantage in the Arboretum, the student should already possess such a degree of botanical knowledge as is implied in a thorough acquaintance with "Gray's Botanical Text Book," or any equivalent work. He must have some knowledge of horticultural methods and practice, and should be familiar with the native trees at least of the New England States.

Application for admission may be made to the Director, with whom the fees for instruction may be agreed upon. Fees may be remitted in consideration of services performed.

In the spring and autumn Mr. JOHN GEORGE JACK conducts a series of Lectures and Field Meetings on Wednesday afternoons and on Saturday mornings for the purpose of supplying popular instruction about the Trees and Shrubs which grow in New England.

EXERCISE AND ATHLETIC SPORTS.

THE HEMENWAY GYMNASIUM.

OFFICERS.

Dudley Allen Sargent, A.M., M.D., S.D., Director.
James Gray Lathrop, *Instructor in Athletics.*
Frances Dohs, *Instructor in Gymnastics.*
Clarence Bertrand Van Wyck, *Recorder.*

This Gymnasium, named in honor of Augustus Hemenway, of Boston, of the Class of 1875, who gave it to the University, is a handsome and spacious structure, built in 1878 and equipped with the utmost thoroughness.

The growth of the University and the interest in this department during the past fifteen years has necessitated an increase of room and facilities which Mr. Hemenway has met by making an extensive addition to the Gymnasium in 1895.

This new addition affords an increased floor area of 15,000 square feet with locker, bathing, and dressing rooms, accommodating 2500 students.

An area of some 12,000 square feet of ground immediately connected with the Gymnasium has been enclosed, graded, and covered with asphalt, to afford facilities for practising gymnastic exercises and games in the open air.

The Gymnasium proper has a floor space of 30,000 square feet including a large main hall for general exercise, a running-gallery, rowing-room, and basement for Bowling Alleys, Hand Ball Courts, and rooms for Fencing, Sparring, Wrestling, and other exercises.

The Main Hall is furnished with a large variety of light and heavy gymnastic apparatus and all the best patterns of the modern developing appliances.

The building is lighted throughout by electricity and warmed and ventilated by a novel arrangement of steam pipes, light wells, and air shafts.

The Gymnasium is open to all members of the University free of expense, on week days from 11 A.M. to 1 P.M., 3 to 5.30, and 8 to 10 P.M., except on Saturdays, when it is closed at 7 o'clock.

The attendance is voluntary, and the system adopted is one designed to meet the special wants of each individual. Realizing the great diversity in age, size, and strength, as well as in health, of the students who attend the University, the Director makes no attempt to group them into classes pursuing the same course of exercises.

Upon entering the University, each student is entitled to an examination by the Director, in which his physical proportions are measured, his strength tested, his heart and lungs examined, and information solicited concerning his general health and inherited tendencies. From the data thus procured, a special order of appropriate exercises is made out for each student, with specifications of the movements and apparatus which he may best use. These exercises are marked in outline on cards without charge, or in handbooks accompanied by charts at a small expense. After working on this prescription for three or six months, the student is entitled to another examination, by which the results of his work are ascertained, and the Director enabled to make a further prescription. Students holding Scholarships are expected to be examined twice a year; and those desiring to enter Athletic Contests are required to be examined by the Director and to obtain his permission so to do.

In addition to the individual prescriptions, there are classes in Free Movements and Light Gymnastics designed to afford an opportunity for general development to all students of the University who are not members of the athletic teams or who are not in need of specially prescribed exercises.

All students of Harvard University desiring to enter as competitors in Athletic Contests are required to give evidence of their ability by making the following strength tests according to the Intercollegiate Agreement, in addition to the regular physical examinations: —

Candidates for the University Crew and Foot Ball Team and Weight Throwers are expected to make a total strength test of 700 points.

Candidates for the University Ball Nines and Track and Field Events, Class Crews and Foot Ball Teams and Gymnastic, Wrestling and Sparring Contests are expected to make a total strength test of 600 points.

Candidates for the University LaCrosse, Cricket, Tennis, and Golf Teams, Class Ball Nines, and Class Track and Field Events are expected to make a total strength test of 500 points.

These points are reckoned as follows: — The number of kilos. lifted with the back and legs straight, and the number of kilos. lifted with the legs bent, added to the strength of the grip of the right and left hand, expiratory power as tested by the manometer, and one-tenth of the weight in kilos. multiplied by the number of times that the person can raise his weight by dipping between the parallel bars and pulling his weight up to his chin on the horizontal bar. One twentieth of the lung capacity

may be substituted for the lung strength or expiratory test. Where the strength test falls below the desired standard the capacity of lungs is taken into account in summing up the condition.

These tests are made and certificates granted on any day, excepting Saturday and Sunday, between 2 and 4 P. M. within two weeks previous to a contest, but no examinations are made or certificates granted on the day of the contest.

COMMITTEE ON THE REGULATION OF ATHLETIC SPORTS.

FACULTY MEMBERS.

Ira Nelson Hollis, A.M., L.H.D., *Professor of Engineering*, Chairman.
Edwin Herbert Hall, Ph.D., *Professor of Physics.*
Archibald Cary Coolidge, Ph.D., *Assistant Professor of History.*

GRADUATE MEMBERS.

James Jackson Storrow, A.B.
Augustus Peabody Gardner, A.B.
Bertram Gordon Waters, A.B.

UNDERGRADUATE MEMBERS.

Samuel Watts Lewis, *Class of 1900*, Secretary.
Raynal Cawthorne Bolling, *Class of 1900.*
John White Hallowell, *Class of 1901.*

Eliot Spalding, Graduate Treasurer.

The President and Fellows established the Committee on the Regulation of Athletic Sports by the following vote, to which the Overseers consented: —

"*Voted*, That the following be adopted as one of the standing rules and orders of the President and Fellows and the Board of Overseers: —

"A Committee for the Regulation of Athletic Sports shall hereafter be annually appointed and chosen as follows: three members of the University Faculties, and three graduates of the College — these six to be appointed by the Corporation with the consent of the Overseers; and also

three undergraduates to be chosen during the first week of the College year by the majority vote of the following students: the Presidents of the Senior, Junior and Sophomore classes, and a representative from each of the following athletic organizations: the Boat Club, the Cricket Club, and the Athletic, Base-ball, Foot-ball, Cycling, and Tennis Associations, who shall be called together for the purpose of making this choice by the President of the University.

"This Committee shall have entire supervision and control of all athletic exercises within and without the precincts of the University, subject to the authority of the Faculty of Arts and Sciences, as defined by the Statutes."

Under the authority thus conferred the Committee exercises a general supervision over the grounds and buildings devoted by the University to athletic sports and exercise; over the times and places of athletic contests; and over the physical condition of those engaged in them. The regulations framed by the Committee forbid the employment of unauthorized persons as trainers, and require intercollegiate and other contests to be held at such times and places as will cause least interference with study. No person is permitted to take part in athletic contests without a physical examination by the Director of the Gymnasium, and his permission so to do. No person who is not a student of some department of the University in full and regular standing is allowed to take part in any athletic contest or exhibition. The Committee chooses its own officers, and appoints a Graduate Treasurer, who exercises supervision over the accounts of all athletic organizations using University grounds or buildings. The Committee makes a report annually to the President of the University.

BUILDINGS FOR ATHLETIC USES.

Besides the Gymnasium, four other buildings are held, either by the University or by trustees, for the exclusive use of students of the University.

A substantial building for the use of the Base-ball and other teams was erected in 1897–98 to the memory of Henry Astor Carey, Esq., in exchange for the building on Holmes Field surrendered to the University for purposes of instruction. It has a floor space of 7700 square feet.

The University Boat House, situated on Charles River, about half a mile from the College, is used principally by regular crews. It has a floor space of 6893 square feet.

By the gift of George Walker Weld, of the Class of 1860, a second boat house was erected in 1889–90 for the use chiefly of students not rowing

on regular crews. It is situated about one third of a mile from the College, and has lockers and boat-storage sufficient for the use of 300 students.

By subscriptions from Alumni the "Locker Building" was erected in 1893–94 on Soldier's Field. This building has a capacity of 1500 lockers, and contains also large shower-rooms and dressing-rooms.

A Gate Lodge was erected near the entrance to Soldier's Field during the fall of 1899. It contains one large room for the general use of students and their friends, and several smaller rooms for the use of the attendant in charge of the athletic grounds.

PLAY-GROUNDS.

For out-door exercise, the University and the students themselves have provided three grounds. Holmes Field, adjacent to the Gymnasium, is about 450 feet by 600 feet, and has an unencumbered area of about five acres.

Jarvis Field, a few hundred feet from Holmes Field, is about four acres in area, and is used exclusively by tennis-players.

By a gift made to the University in 1890 by Henry Lee Higginson, of the Class of 1855, the students are provided with an additional play-ground of twenty acres. This new field, named by the donor the Soldier's Field, is situated in Allston, at a short distance across the Charles River, and is within easy reach of the College Yard. It is used for foot-ball and other sports. The students have erected upon this field permanent seats for fifteen thousand persons.

SCHOOLS FROM WHICH STUDENTS HAVE ENTERED THE LAWRENCE SCIENTIFIC SCHOOL 1894–99 INCLUSIVE.

Adams Academy, Quincy, Mass.
Albany (N.Y.) State Normal College.
Albion College, Albion, Mich.
Allen Brothers' Private School, Newton, Mass.
Amherst College, Amherst, Mass.
Ansonia (Conn.) High School.
Arkansas Industrial University, Fayetteville, Ark.
Arms Academy, Shelburne Falls, Mass.
Auburn (N.Y.) High School

Baltimore (Md.) City College.
Barton Academy, Mobile, Ala.
Bath (Me.) High School.
Belmont (Cal.) School.
Belmont (Mass.) School.
Berkeley High School, New London, Conn.
Berkeley School, Boston, Mass.
Bethany College, Bethany, W. Va.
Blake's, W. S., Private School, New York, N.Y.
Boston (Mass.) College.
Boston (Mass.) Commercial College.
Boston (Mass.) English High School.
Boston (Mass.) Free Atelier.
Boston (Mass.) Latin School.
Boston (Mass.) University.
Boys' High School, Brooklyn, N.Y.
Bradford (Pa.) High School.
Bridgeport (Conn.) High School.
Brockton (Mass.) High School.
Bromfield School, Harvard, Mass.
Brookline (Mass.) Grammar School
Brookline (Mass.) High School.
Brooklyn (N.Y.) Evening Schools.
Brooklyn (N.Y.) High School.
Brooklyn (N.Y.) Polytechnic School.

Brown University, Providence, R. I.
Browne & Nichols's School, Cambridge, Mass
Browning's, J. A., Private School, New York, N.Y.
Bryant & Stratton's School, Boston, Mass.
Buchtel College, Akron, O.
Buffalo (N.Y.) High School.
Bulkeley School, New London, Coun.
Bussey Institution, Jamaica Plain, Mass.

Cambridge (Mass.) English High School.
Cambridge (Mass.) Latin School.
Cambridge (Mass.) Manual Training School.
Case School of Applied Science, Cleveland, O.
Cedarcroft, Cornwall, N.Y.
Centre College, Danville, Ky.
Charlestown (Mass.) High School.
Chauncy Hall School, Boston, Mass.
Chelsea (Mass.) High School.
Chem. Bact. Institute, Berlin, Germany.
Chenault's, D. A., School, Louisville, Ky.
Chicago (Ill.) Latin School.
Chicago (Ill.) Manual Training School.
Cleveland (Ohio) Central High School.
Coburn Classical Institute, Waterville, Me.
Cohasset (Mass.) High School.
Colby Academy, New London, N. H.
Colby University, Waterville, Me.
College of the City of New York, N.Y.
Colorado High School, Colorado Springs, Col.
Colorado School of Mines, Golden, Colo
Columbia High School, So. Orange, N. J.
Columbia University, New York, N.Y.
Concord (Mass.) High School.
Concord (Mass.) School.
Concord (N. H.) High School.
Condon School, New York, N.Y
Conn. Literary Institute, Duffield, Conn.
Cornell University, Ithaca, N.Y.
Cutler's, A. H., Private School, New York, N.Y.
Cutler's, E. H., School, Newton, Mass.

Dartmouth College, Hanover, N.H.
David Prouty High School, Spencer, Mass

Dedham (Mass.) High School
Deering (Me.) High School.
DeLancey School, Philadelphia, Pa.
De La Salle School, Chicago, Ill.
Denison (Texas) High School.
Denison University, Granville, Ohio.
DePauw University, Greencastle, Ind.
Detroit (Mich.) College of Law.
Detroit (Mich.) High School.
De Veaux School, Niagara Falls, N.Y
Dickinson (Mass.) High School.
Drisler School New York, N.Y.
Dubuque (Ia.) High School.
Durfee, H. M. C., High School, Fall River, Mass.

Eayr's, W. N., Private School, Boston, Mass.
Elmwood School, Buffalo, N.Y.
Evening Institute, Y. M. C. A., Boston, Mass

Fiske University, Nashville, Tenn.
Fitchburg (Mass.) High School.
Flexner's, Abraham, School, Louisville, Ky.
Florence (S. C.) Public Schools.
Florida Agricultural College, Lake City, Fla.
Flushing (N.Y.) High School.
Fordham (N.Y.) College.
Foxcroft (Me.) Academy.
Franklin (Ind.) College.
Friends' Academy, New Bedford, Mass.
Frye's, C. B., School, Boston, Mass.

Gardiner (Me.) High School.
Gardner (Mass.) High School.
Gloucester (Mass.) High School.
Grand Island (Neb.) High School.
Groton School, Groton, Mass.
Gunnery School, Washington, Conn.

Hale's, Albert, Private School, Boston, Mass.
Harvard College, Cambridge, Mass.
Harvard Graduate School, Cambridge, Mass.
Harvard Medical School, Boston, Mass.

Harvard School, Chicago, Ill.
Haverford (Pa.) College Grammar School.
Haverhill (Mass.) High School.
Haverhill (Mass.) Public School
Heathcote School, Buffalo, N.Y.
Highgate School, England.
Hildreth's, Arthur, School, Boston, Mass.
Hill School, Pottstown, Pa.
Hingham (Mass.) High School.
Holbrook's School, Sing Sing, N.Y.
Holderness School, Plymouth, N. H.
Hopkinson's, J. P., Private School, Boston, Mass.
Hyde Park (Mass.) High School.

Illinois State Normal University, Normal, Ill.
Indianapolis (Ind.) High School.
Ipswich (Mass.) High School.
Ironton School, Ironton, Penn.

Jenner's, Wm., Private School, Syracuse, N.Y.

Keene, (N. H.) High School.
Keith's, M. S., Private School, Boston, Mass.
Kendall's, Joshua, Private School, Cambridge, Mass.
Kentucky University School, Louisville, Ky.
Kenwood School, Chicago, Ill.
King's School, Stamford, Conn.

Lake Forest (Ill.) Academy.
Lansingburg (N.Y.) Grammar School.
Lausanne (Switzerland) Public Schools.
Lawrenceville (N. J.) High School.
Lawrenceville School, Lawrenceville, N. J.
Lehigh University, So. Bethlehem, Pa.
Leland Stanford Jr. University, Stanford University, Cal.
Lincoln (Mass.) High School.
Louisville (Ky.) College of Pharmacy.
Louisville (Ky.) High School.
Lowell (Mass.) Commercial College.
Lowell (Mass.) High School.
Lowell (Mass.) Normal School.
Lynn (Mass.) Classical High School.
Lynn (Mass.) High School.

McGill University, Montreal, Canada.
Madison School, New York, N.Y.
Maine State College, Orono, Me.
Malden (Mass.) High School.
Mass. Agricultural College, Amherst, Mass.
Mass. Institute of Technology, Boston, Mass.
Meadville (Pa.) Theological School.
Medford (Mass.) High School.
Medway (Mass.) High School.
Melrose (Mass.) High School.
Michigan Agricultural College, Agri. Coll., Mich.
Michigan Military Academy, Orchard Lake, Mich.
Michigan State Normal College, Ann Arbor, Mich.
Milton Academy, Milton, Mass.
Mohegan Lake School, Peekskill, N.Y.
Montclair (N. J.) High School.
Mosher's, C. E. E., Prep. School, New Bedford, Mass.
Mt. St. Mary's (Md.) College.

Nazareth Hall Military Academy, Nazareth, Pa.
New Albany (Ind.) High School.
New Bedford (Mass.) High School.
New York (N.Y.) College of Pharmacy.
New York University, New York City.
Newark (N. J.) Technical School.
Newburyport (Mass.) High School.
Newton (Mass.) High School.
Noble & Greenough's School, Boston, Mass.
Norristown (Pa.) Preparatory School.
Northern Ind. Normal School, Valparaiso, Ind.
Northwestern University, Evanston, Ill.
Norwich (Conn.) Free Academy.

Oberlin College, Oberlin, O.
Olean (N.Y.) High School.
Owego (N.Y.) Free Academy.
Oxford (Me.) High School.

Peekskill (N.Y.) Military Academy,
Pennacook Normal School, Pennacook, N. H.
Penn. Military Academy, Chester, Pa.
Penn Yan Academy, Penn Yan, N.Y.

Perk Institute, Alleghany City, Pa.
Philadelphia (Pa.) College of Pharmacy.
Phillips Academy, Andover, Mass.
Phillips Academy, Exeter, N. H.
Phoenix (Ariz.) High School.
Pictou (N. S.) Academy.
Pittsburg (Pa.) Academy.
Pomfret School, Pomfret Center, Conn.
Portland (Me.) High School.
Powder Point School, Duxbury, Mass.
Pratt Institute, Brooklyn, N.Y.
Prospect Union, Cambridge, Mass.
Providence (R. I.) High School.
Provincial Normal School, Truro, N.S
Purdue University, Lafayette, Ind.

Quincy (Mass.) High School.

Racine College, Racine, Minn.
Raven School, Youngstown, O.
Reading (Mass.) High School.
Reading (Pa.) High School.
Red Hook (N.Y.) Public School.
Rensselaer Polytechnic Institute, Troy, N.Y.
Richmond (Ind.) High School.
Rideout's, Miss, Private School, Boston, Mass.
Ridge School, Washington, Conn.
Rockland (Mass.) High School.
Rogers High School, Newport, R. I.
Roxbury (Mass.) Drawing School.
Roxbury (Mass.) High School.
Roxbury (Mass.) Latin School.
Rutgers Preparatory School, New Brunswick, N. J.

St. Francis Xavier College, Antigonish, N.S.
St. John (N.B.) High School.
St. Joseph (Mich.) High School.
St. Louis (Mo.) High School.
St. Mark's School, Southborough, Mass.
St. Mary's College, Montreal, Can.
St. Paul's School, Concord, N. H.
St. Paul's School, Garden City, L. I.

St. Thomas Aquinas College, Cambridge, Mass.
Sach's Collegiate Institute, New York City.
Salem (Mass.) High School.
Sandwich (Mass.) High School.
Saugus (Mass.) High School.
School of Arts and Artisans, New York, N.Y.
Sedgwick Institute, Great Barrington, Mass.
Shady Side Academy, Pittsburg, Pa.
Smith Academy, St. Louis, Mo.
Smith's Private School, Cambridge, Mass.
Somerville (Mass.) High School.
Somerville (Mass.) Latin School.
Southbridge (Mass.) High School.
Springfield (Mass.) High School.
State Normal School, Bridgewater, Mass.
State Normal School, Bloomsbury, Pa.
State Normal School, California, Pa.
State Normal School, Columbus, O.
State Normal School, New Britain, Conn.
State Normal School, New Pultz, N.Y.
State Normal School, Oneonta, N.Y.
State Normal School, Terra Haute, Ind.
State Normal School, Westfield, Mass.
Stile's Preparatory School, Ithaca, N.Y.
Stone's, C. W., School, Boston, Mass.
Stowell's, G. L., Private School, Lexington, Mass.

L. A. Tallmadge's School, Morristown, N.J.
Taunton (Mass.) High School.
Thayer Academy, So. Braintree, Mass.
Torrington (Conn.) High School.
Trinity School, New York City.
Tufts College, Tufts College, Mass.
Tulane University, New Orleans, La.

Union College, Schenectady, N.Y.
Université de France, Sorbonne, France.
University of Chicago, Chicago, Ill.
University of Cincinnati, Cincinnati, O.
University of Illinois, Urbana, Ill.
University of Kentucky, Lexington, Ky.
University of Maine, Orono, Me.
University of Michigan, Ann Arbor, Mich.

University of Minnesota, Minneapolis, Minn.
University of Nebraska, Lincoln, Neb.
University of North Carolina, Chapel Hill, N. C.
University of Ottawa, Ottawa, Can.
University of Pennsylvania, Philadelphia, Pa
University of the South, Sewanee, Tenn.

University of Vermont, Burlington, Vt.
University of Toronto, Toronto, Can.
University of Wisconsin, Madison, Wis.
University School, Bridgeport, Conn.
University School, Chicago, Ill.
University School, Cleveland, O.
Uppingham School, England.
Urbana University, Urbana, O.

Vermont Academy, Saxton's River, Vt.
Volkmann School, Boston, Mass.

Waban School, Waban, Mass.
Wabash College, Crawfordsville, Ind.
Wakefield (Mass.) High School
Waltham (Mass.) High School.
Warner, B. & S., College, Providence, R.I.
Washington (D.C.) High School.
Washington University, St. Louis, Mo.
Watertown (Mass.) High School.
Wesleyan University, Delaware, O.
West Division High School, Milwaukee, Wis
West Hartford (Conn.) High School.
W. Va. University, Morgantown, W. Va.
Westbrook Seminary, Westbrook, Mass.
Western High School, Washington, D. C.
Westminster School, New York, N.Y.
Weston (Mass.) High School.
William Jewell College, Liberty, Mo.
Williams College, Williamstown, Mass.
Williston Seminary, Easthampton, Mass.
Wilson & Kellogg's School, New York, N.Y.
Winchester (Mass.) High School.
Winthrop (Mass.) High School.
Wisconsin State Normal School, Oshkosh, Wis.
Woburn (Mass.) High School.

Woodbridge School, New York, N.Y.
Worcester (Mass.) Academy.
Worcester (Mass.) Classical High School.
Worcester (Mass.) English High School.
Worcester (Mass.) Polytechnic Institute.

Yale University, New Haven, Conn.

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The Academic Year begins on the Thursday following the last Wednesday in September.

Commencement Day is on the last Wednesday in June.

The Vacation begins on the day after Commencement Day, and ends on the last Wednesday in September.

There are two short recesses, at Christmas and in April.

For copies of this Catalogue, Students' Expenses, etc., and for further information, address

J. L. LOVE, Secretary, Cambridge, Mass.

☞ All official letters and all applications, addressed to the Administrative Board of the School, or to the Dean, should be sent to the Secretary's Office, 16 University Hall.